Perfusor® compact S

Service-Manual

Version 2.1 english

B BRAUN
SHARING EXPERTISE

This Service-Manual is valid for

Designation	Part No.
Perfusor® compact S (200 - 240 V)	0871 4843

This Service Manual is available under the following part number:

Designation	Part No.
Perfusor® compact S, English	8713 9114

Languages of this Manual

The Service Manual for this unit can be supplied in the following languages:

Designation	Part No.
Perfusor® compact S, German	8713 9113
Perfusor® compact S, USA	8713 9115

The complete Service-Manual contains the following pages:

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Important Preliminary Remarks 0

Service Work

The present manual is for your information only. The possession of this manual does not authorize the performance of service work. Service tasks may only be executed by persons, who

- have received appropriate training on the system from B. Braun
- are included in the revision service
- possess the necessary test equipment and mechanical aids, and
- fulfill the personal requirements (training and knowledge).

Technical Safety Checks

The user is obliged to perform or to have performed the Technical Safety Checks on those medial products for which these checks have been prescribed by the manufacturer and to carry them out according to the indications of the manufacturer as well as the generally approved technical standards while adhering to the periods stated (§ 6 MP BetreibV).

B. Braun also recommends training on the Technical Safety Checks, or to perform at least the steps indicated in the current version of the manual, as:

- the TSC requires that the instructions in the manuals are observed
- the manuals are a reference for measurements
- depending on the unit type, the Service Program must be called which may lead to a dangerous unit condition in case of inappropriate operation. Furthermore, a special service connector may be necessary.

Current Versions

This manual version corresponds to the state when the manual was written. B Braun reserves the right to make technical modifications. The state of the revision is indicated by the index number in the footer of every page.

Revision Service

The possession of this manual does not automatically mean inclusion in the revision service. You will be included in the revision service after:

- technical training by B. Braun Melsungen or
- a written order placed with the sales department of B. Braun (fee required).

Responsibility of the Manufacturer

The manufacturer, person who assembles, installs or imports the device can only be held responsible for safety, reliability and performance if

- mounting, enhancements, new settings, changes or repairs are carried out by duly authorized persons,
- the electrical installation in the corresponding room meets the requirements of the VDE 0107, VDE 0100 part 710 or IEC 60364-7-710 and the national standards,
- the device is used in accordance with the instructions for use and the Service Manual,
- the Technical Safety Checks are performed at regular intervals,
- a current manual which corresponds to the revision state is used when carrying out maintenance, repair and service,
- the service technician takes part in the revision service,
- the technician has participated in a technical training course for the specific B. Braun unit.

Quality Management

B. Braun is certified in accordance with DIN EN ISO 9001 and ISO 13485. This certification also includes maintenance and service.

The unit has the CE label. The CE label confirms that the device corresponds to the "Directive of the Council for Medical Products 93/42/EC" of June 14, 1993.

Checks and Repair

Training may only be performed by B. Braun. The possession of the manual does not authorize the performance of repairs. The instructions on electrostatic sensitive components (ESD standards) must be observed.

After repair a device check or diagnosis is to be carried out.

Notes on ESD

Semiconductors can be destroyed by electrostatic discharge. Especially MOS components can be damaged by interference from electrostatic fields, even without discharge via contact. This type of damage is not immediately recognizable. Unit malfunctions can even occur after a longer period of operation.

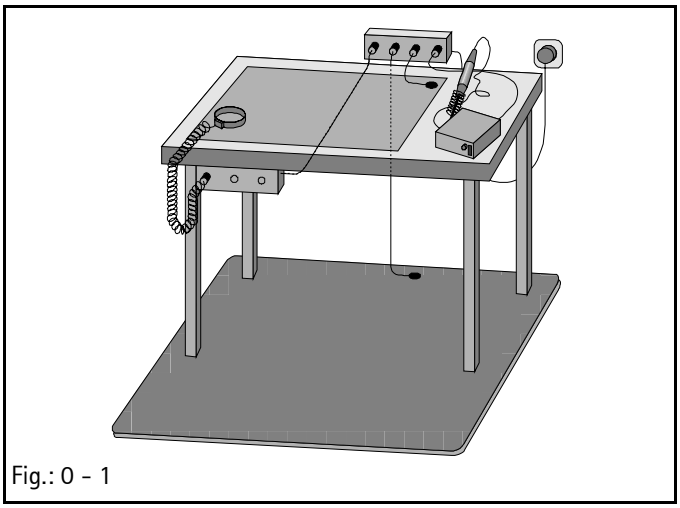

Fig.: 0 - 1

Each workstation must be equipped according to the recommendations with the necessary static protective measures, if ESD components or boards are handled.

Each workstation must be equipped with a conductive table surface. The conductive surface, the soldering iron or the soldering stations must be grounded via protective resistors.

Chairs must be of antistatic design. The floor or floor mats should be of electrically conductive material.

Personnel must wear conductive wristbands which are connected to a central ground potential via protective resistors, e.g. the ground contact of a wall outlet. Furthermore it is recommended that personnel wear cotton clothing and electrically conductive shoes to prevent electrostatic charge.

Spare Parts and Test Equipment

Only use original spare parts from the manufacturer. Do not tamper with assembly groups which can only be exchanged completely. The spare parts required are listed in Section 9.

Service personnel are responsible for the calibration of their test equipment. Original test equipment can be calibrated at the works of B. Braun. Further information is available upon request.

Setting Off

Additional notes and warnings are set off as follows:

Note

Is used for additional or special notes concerning information and working steps.

CAUTION

Is used for working steps which may result in damage to the unit, system or to a connected device.

WARNING

IS USED FOR WORKING STEPS WHICH MAY RESULT IN PERSONAL INJURY.

References to chapters are shown as follows
(see "Setting Off" ➨ pg. 0 - 8)

References to figures and tables are shown as follows
Fig.: 2 - 3 or Table 2 - 1

References to item numbers in figures are shown as follows (Fig.: 1 - 1 / Item 1)
In this case "Fig.: 1 – 1" is the figure number and "Item 1" the item number within the figure.

When the Service Manual is stored as pdf-file, these references are displayed green. Click with the mouse button on a reference to jump to the corresponding source.

Menu commands are described as:
Menu ***File***.

List of Abbreviations

Abbreviations which are not generally known, but are used in this manual, are listed below.

A-Module	Analog Module
DMS	Strain gauge
E-Module	Electronic Module
ESD	Electrostatic Discharge
IfU	Instructions for Use
LCD	Liquid Crystal Display
MFC	Multi-Function Connector
PS-Module	Power Supply Module
TSC	Technical Safety Checks
TEMP	Temperature

Contact Persons 0

Technical Training

Via local representative.

Entry for Technical Training

Application for a technical training course must be made via the responsible representative.

Ordering of Spare Parts and Test Equipment

Please contact your local B. Braun subsidary.

International Technicians (Intercompany)
Nadja Machal
Fax: +49 5661 / 75 -47 89
e-mail: nadja.machal@bbraun.com

Service Hotline

Karl Tippel, Tanja Kördel
Phone: +49 5661 / 71 - 35 25
Fax: +49 5661 / 71 - 35 26
e-mail: karl.tippel@bbraun.com
e-mail: tanja.koerdel@bbraun.com

Return of Spare Parts and Test Equipment

B. Braun Melsungen AG
Schwarzenberger Weg 73-79
Wareneingang Werk C
34 212 Melsungen
Germany

Safety Officer (§ 30 MPG)

Dr. Dirk Woitaschek
e-mail: dirk.woitaschek@bbraun.com

Translation

PAS GmbH, Brückner GmbH, Germany

0 Contact Persons

For your notes:

System Overview 1

Physical Construction

The Perfusor® compact S is a compact, stacking, portable and light-weight syringe pump which is used for precise dosing of small to high volumes of fluids in infusion and alimentary therapies.

The standard delivery rate range is 0.1 to 200 ml/h (in increments of 0.01 ml/h).

All important information is displayed on an LCD-display. The Perfusor® compact S features: simple operation via a membrane keyboard and a microprocessor-controlled function process and monitoring. The Perfusor® compact S has a long service life and is easy-to-service due to its modular design. Individual modules can be replaced easily and quickly, and the Service Program runs on a PC.

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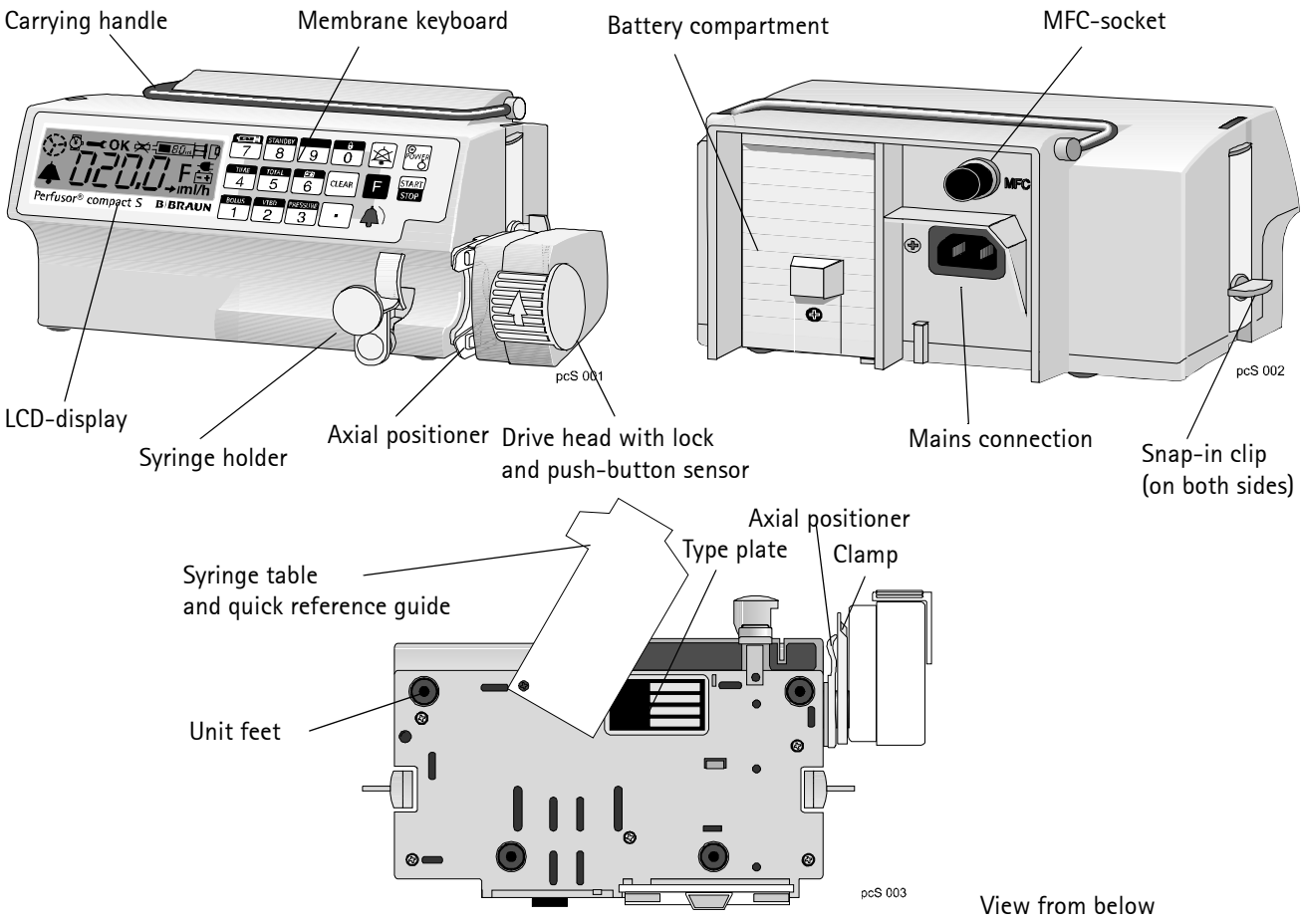


Fig.: 1 - 1

Function

The electronics of the Perfusor® compact S consists of the following components:

1. A-Module with MFC-board as the central power supply and interface
2. E-Module as operating and control unit
3. Drive unit, consisting of
   - drive board with the complete sensor technology, light barriers for syringe pre- and end-alarm, syringe size recognition and motor operation control
   - pressure sensor board with sensor for an inserted syringe and force sensor amplifier
   - positive locking sensor board with sensor for the frictional connection between nut and spindle of the drive
   - pressure sensor (pressure).

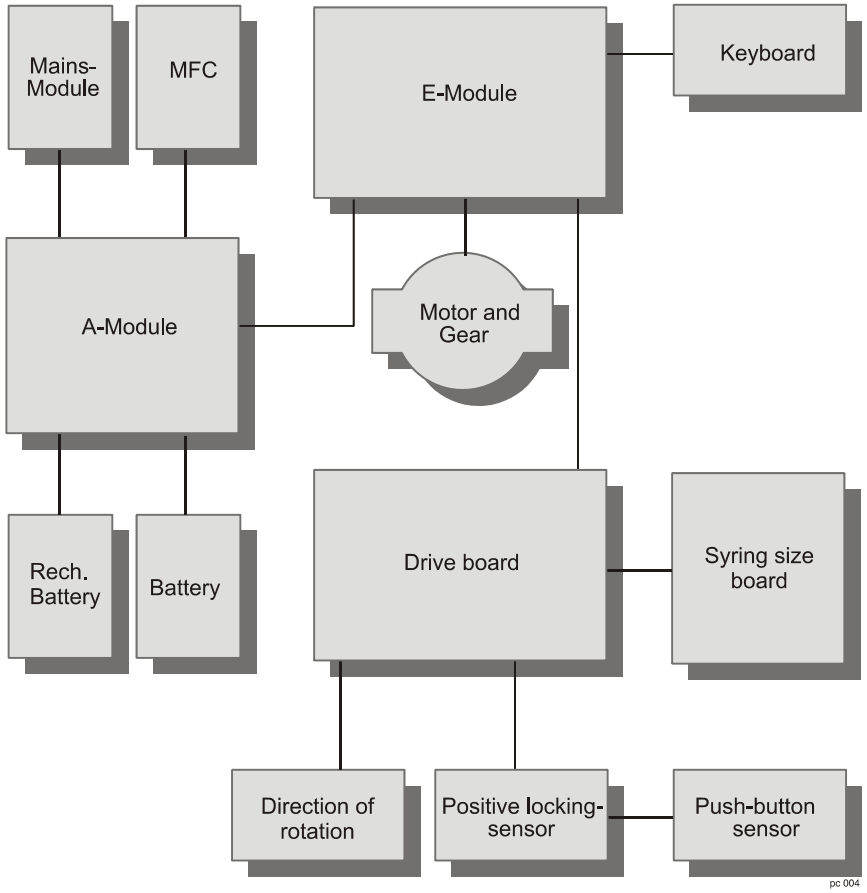


Fig.: 1 - 2 Block diagram

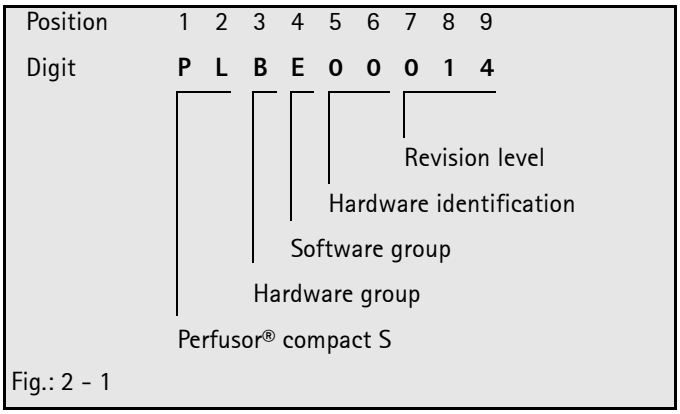
Accessories

Designation	Ord. No.
Unit connecting lead 220-240 V	3450 2718
Pole clamp (universal clamp, rotating)	3450 9054
Battery pack	3450 1690

For your notes:

Software 2

Approved Software Versions


Position 1 2 3 4 5 6 7 8 9
Digit P L B E 0 0 0 1 4
Revision level
Hardware identification
Software group
Hardware group
Perfusor® compact S
Fig.: 2 - 1

The software and hardware revision level is displayed on the LCD-display when the unit is switched on. The characters on the display must correspond with the indication on the instructions for use.

Version PLBD00010	first approved software version
Version PLBE00010	with Dianet Star
Version PLBE00011	with Dianet Star and modified signalling in case of a missing battery
Version PLBE00013	Dianet Star, enhanced
Version PLBE00014	with Dianet Star and modified syringe size recognition

Version Display during Switch-On Test

1. Switch on unit.
2. The following information is displayed one after the other on screen:

   88:8.8

   11:1.1

   22:2.2

   55:5.5

   b:E. Reference to the instructions for use (hard- and software group)
3. The Perfusor® compact S switches over to normal operation.

Extended Version Display during Switch-On Test

1. Switch on unit.
2. Press the F button and keep the button pressed during normal switch-on test. The following information (examples) appears on screen after the information displayed during normal switch-on test:

00	Hardware identification (no importance for the Perfusor® compact S)
0101	Software version
0063	0063 operating hours
0004	Maintenance interval timer

3. Release the F button to exit. The Perfusor® compact S switches over to normal operation.

Error Messages and Alarms

In case of a unit malfunction a continuous signal is activated, and the function processor displays an alarm and an error code. The error code of the control microprocessor can be queried with the F button. Please state both error codes if you have any questions. Acknowledge alarm and switch device off.

Device Alarms of the Function Processor

LCD-Display	Description
1	Different syringe recognition
2	Different FP- and CMP condition
3	Rate of FP- and CMP different
4	Different function mode
5	Different rate of delivery
6	Different target volume
7	Different step volume (low)
8	Different motor steps
12	Different state/motor state
20	Invalid normal state
21	return from PlcMain
22	Unexpected reset
28	No sync at Plc_Down
29	No sync at Plc_On
30	Different CMP/FP mode ports
31	Invalid mode ports
32	Invalid variable values
33	Error in ROM test
34	Different software version
40	Unexpected interrupt
45	Potentiometer faulty
46	Verst.umsch. / DAC faulty
47	Pressure too low
48	Buffer filling too high
49	Faulty sensor sync
51	Motor on during reverse run
52	Step cumulation > 10 steps

Table 2 - 1 (Part 1 of 3)

LCD-Display	Description
53	Illegal setting of Mot_Ok
54	Diff. result of direction of rotation recognition
55	Reverse polarity of motor
56	Invalid syringe
57	Overflow of motor step counter
59	No sync at Mot_Test
61	Different SW button NEC<>H8
62	Timeout KBD watchdog
63	Error in switch-on test
70	Control timer overflow (int)
71	Control timer underflow
72	Control timer overflow
73	100 ms cycle overflow
75	Tim_WaitUntil overflow
81	Error upon reading of EEPROM
82	Error of syringe data record
83	Error of EEP data consistency
84	Ad difference between NEC/H8
85	Bw difference between NEC/H8
86	Md difference between NEC/H8
90	Syringe state in Oper_Syr
91	Set syringe type
92	Consistency error
93	Difference between setting and display
94	Timer synchronization
95	Syringe type entered
99	Volume/step too large
100	Division by zero
101	Illegal zero pointer
102	Illegal switch to default
103	Too many sync data
104	Odd number of sync data
105	No contact to NEC in OFF
109	Faulty synchronization

Table 2 - 1 (Part 2 of 3)

LCD-Display	Description
110	Alarm on CMP side
111... 119	Motor test 1 ... 9
120	Motor current flow in OFF
121	Battery discharged during test
126	Alarm synchron. (coming)
127	Alarm synchron. (going)

Table 2 - 1 (Part 3 of 3)

Device Alarms of the Control Microprocessor

LCD-Display	Description
128	Unexpected reset
129	Unexpected hardware interrupt
130	Access of zero pointer
131	Attempted division by zero
132	Internal software error
133	Area fault
134	State/motor state
135	Invalid variable values
136	Invalid operating condition
137	Illegal mode – port value
138	H8 indicates GA F14_H8GA_K16
150	Different software versions
151	Double CRC error
152	Synchronization fault
153	Different states
154	Different rates
155	Different F-mode
156	Different mode values
157	Different alarm recognition
158	Different alarm clearance
159	Err. current volume
160	Err. volume preselection
161	Err. volume per step
170	Sensor sync. failed
171... 174	Sensor - dark test error
175	Potentiometer holder defective
176	Invalid strain gauge signal
180	ROM test error
181	RAM test error
182	Keyboard test error column
183	Dynamic memory test
184	Motor test no sync
185	Keyboard test error

Table 2 - 2 (Part 1 of 2)

LCD-Display	Description
186	Timer test error
187	CPU test error
191	Different software buttons
192	Keyboard timeout error
193	Keyboard drive error
200	Cycle > 100 ms
202	Time > Until
203	Watchdog interrupt
205	Time-out when switching H8 on
206	Time-out when switching H8 off
207	No sync at Plc_Down
208	No sync at Plc_On
209	CMP/FP timer – end sync error
220	Different phases (busy)
221	Different phases (idle)
222	Motor on at reverse steps
223	Too many pending steps
224	Motor current error
225	Error of motor step number
226	Reverse polarity of motor
227	Motor steps overflow
230	Different syringe recognition
231	CMP/FP syringe state
232	CMP/FP syringe type set
233	CMP/FP syringe type set
234	CRC error in syringe data record
241... 249	Motor test 1 ... 9 errors
250	Motor ON recognized in OFF-mode
251	Battery voltage low

Table 2 - 2 (Part 2 of 2)

Note

Operating alarms are specified in the instructions for use.

For your notes:

Service Program 3

Current Service Program

Designation	Ord. No.
3.5'' floppy disk	3450 6330
Interface cable	0871 1661

Introduction

The Service Program runs on a PC. All functions are easy to operate in the pulldown-menus as in Windows.

WARNING

NEVER RUN SERVICE MODE WHEN A PATIENT IS CONNECTED!
DO NOT CONNECT THE SERVICE CONNECTOR OR THE SERVICE CABLE WHEN A PATIENT IS CONNECTED TO THE UNIT! FIRST SWITCH THE UNIT OFF BEFORE ANY FURTHER USE AFTER WORKING WITH THE SERVICE CONNECTOR.
CHECK UNIT ACCORDING TO THE PROCEDURAL INSTRUCTIONS FOR INSPECTION (see „Procedural Instructions for Inspection after Operation of the Service Program“ ➨ pg. 3 - 11).

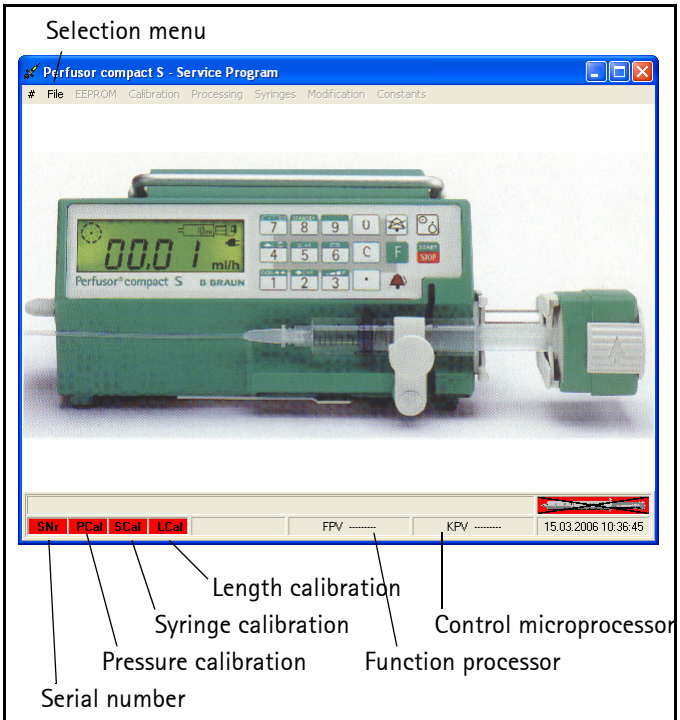


Fig.: 3 - 1

When the Service Program is installed and the PC is connected to the Perfusor® compact S, the following functions can be executed:

- Drive calibration
- Reading / loading pump data
- Displaying operation values
- Displaying and changing parameters
- Saving all data to a floppy disk, hard disk or similar

System Requirements

- PC with WIN 95, 98, 2000 or NT
- Free serial port COM 1 or COM 2
- Disk drive
- Mouse

Installation

1. Insert disk.
2. Start the File Manager or Windows Explorer.
3. Select disk drive.
4. Start Setup.exe file with a double click and follow the instructions. Latest information on the Service Program is documented in the Readme.txt file on the floppy disk.

Uninstall

1. Menu bar of the PC: ***Start*** ➨ ***Programs*** ➨ ***B Braun*** ➨ ***PCS*** ➨ ***Unwise.exe***. The Service Program is deleted.

Working with the Service Program

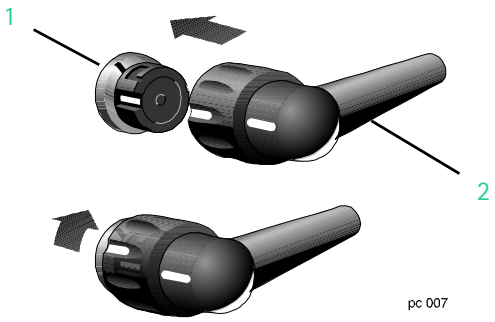


Fig.: 3 - 2

Legend of fig. 3 - 2:

Item	Designation
1	MFC connector on the unit
2	MFC service cable

Preparation

1. Connect service cable (Fig.: 3 - 2 / Item 2) to MFC connector (Fig.: 3 - 2 / Item 1) of the unit and the PC serial port (COM 1 or COM 2).
2. Connect mains cable to the unit.

Start Program

1. Menu bar of the PC: ***Start*** ➨ ***Programs*** ➨ ***B Braun*** ➨ ***PCS*** ➨ ***PCS.exe.*** The Service Program is started.

Configuration

1. Select menu ***File*** ➨ ***Configuration***.
2. Select language and port.
3. Acknowledge with ***OK***.

Connect

1. Select menu ***File*** ➨ ***Connect*** and press F1 button and ON-key on the Perfusor® compact S. If the unit is connected when being switched off (calibration) and are displayed. If the unit is switched on (test syringe size recognition) is additionally displayed.

Display / Save the Unit Settings

Read EEPROM before starting work in a menu. Write EEPROM when work is terminated.

1. Menu *EEPROM* ➨ *Read*
2. Menu *File* ➨ *Save*
3. Menu *File* ➨ *Print.* Printing out the settings is a useful help.
4. Call menu *Modes* ➨ *Modification* and menu *Syringes* ➨ *Syringe Selection* or *Syringe Types*. Note down parameters prior to any modification (e.g. new E-Module).

Adjust Unit Settings

1. Menu *EEPROM* ➨ *Read*
2. Desired modifications / display, please see:
   - *Operation* ➨ *Operating Data*
   - *Modification* ➨ *Modification Data*
   - *Calibration* ➨ *Pressure Calibration*
   - *Syringes* ➨ *Syringe Selection*
   - *Constants* ➨ *Service Interval*
3. Menu *EEPROM* ➨ *Write* transmits data to the device.
4. Menu *File* ➨ *Save* saves the data on the hard disk.
   Enter the user number 0 upon query.
5. Carry out check according to the procedural instructions (see „Check List for Checks after Repair" ➨ pg. 5 - 1).

Calibration after Replacement of E-Module

1. Menu *EEPROM* ➨ *Default*
   Existing values are deleted and reset to the factory settings.
2. Process the following menus:
   - *Calibration*➨ *Serial Number*
   - *Calibration* ➨ *Pressure Calibration*
   - *Calibration* ➨ *Syringe Type Calibration*
   - *Calibration* ➨ *Length Calibration*
3. Reset user settings in *Modification* ➨ *Modification Data*, if necessary.
4. Reset syringe types according to specific user requirements. Delete syringes which are not required, if necessary, load additional syringes or a syringe table which was created for the user.
5. Menu *EEPROM* ➨ *Write* transmits data to the device.

6. Menu *File* ➨ *Save* saves the data on the hard disk. Enter the user number 0 upon query.
7. Carry out check according to the procedural instructions (see „Check List for Checks after Repair" ➨ pg. 5 - 1).

Calibration after Replacement of Drive

1. Menu *EEPROM* ➨ *Read*
2. Edit the following menus:
   - *Calibration* ➨ *Pressure Calibration*
   - *Calibration* ➨ *Syringe Type Calibration*
   - *Calibration* ➨ *Length Calibration*
3. Menu *EEPROM* ➨ *Write* transmits data to the device.
4. Menu *File* ➨ *Save* saves data on the hard disk. Enter the user number 0 upon query.
5. Carry out check according to the procedural instructions (see „Check List for Checks after Repair" ➨ pg. 5 - 1).

Default Data

The Service Program contains the Default.dat file with the factory settings of the Perfusor® compact S. These values can be adjusted via the Syringe or Modes menu if required.

State as delivered:

Max. delivery rate (basal rate) . . . . . 200.0 ml/h

Min. delivery rate (basal rate) . . . . . 0.1 ml/h

Bolus rate . . . . . 1.200 ml/h

Staff call . . . . . dynamic at pre-alarm

Alarm tone in case of alarms. . . . . .3 Hz

Alarm tone in case of pre-alarms . . . . . .static

Pressure stage. 3

Syringes. . . . . Syringe selection

Service interval . . . . . 20440 hrs.

Syringe Size Recognition Test (possible only during operation) (see „Syringe Recognition" ➨ pg. 5 - 4)

1. Menu *Calibration* ➨ *Syringe Size Test*. The information of the syringe size recognition is read.
2. Close syringe holder without inserted syringe or gauge. The syringe must not be recognized.
   - Flashing syringe cylinder symbol without size specification
   - Syringe size (mm/10): 0

3. Pull out syringe holder and turn it clockwise.
   The syringe must not be recognized.
   - Flashing syringe cylinder symbol without size specification
   - Syringe size (mm/10): > 340
4. Insert 0-point and potentiometer calibration gauge and closed syringe holder. Check according to the following table.

Calibration Gauge	Admissible Measuring Range
9.0 mm	0... 94 mm / 10
15.7 mm	157 ± 4 mm / 10
23.4 mm	234 ± 4 mm / 10
33.0 mm	330 ± 4 mm / 10

Note

The total of the deviations of measurements 2, 3, and 4 must not exceed 1 mm.

What to Do if... (Troubleshooting)

... the length calibration does not start?

Could communication be started successfully? Does the motor still not start?
Then: Select Termination. Switch off pump. Repeat communication start. Switch pump on again.

... the communication to the pump is missing?

Is the service cable connection okay? Is the MFC correctly connected?
Then: Select Termination. Switch off pump. Repeat communication start. Switch pump on again.

... the communication cannot be started?

Was the setting in the File / Configuration (COM 1 or 2) menu selected correctly? Is the service cable connection okay? Is the MFC correctly connected?

... Problems in Windows 2000

1. Slow data transfer when EEPROM is read and written, sporadic program crashes.
   - Change settings of the file C:\WINNT\System32\CONFIG.NT
   - This file can be modified with the Editor program, for example. Change setting of "files=40" (last line) to "files=99". Do not forget to save the modification.
2. Error message in syringe recognition test during running operation.
   - Change COM port setting in the System Control.
   - Call Device Manager and search the setting of the COM port.
   - Activate or deactivate the "Use FIFO Buffer" in "Port Settings -> Enhanced".
   - As this setting depends on the hardware, the corresponding values must be determined by experiment.

Menu Commands (Overview)

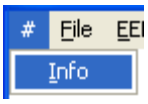


Fig.: 3 - 3

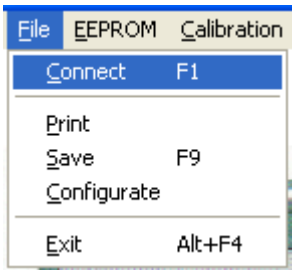


Fig.: 3 - 4

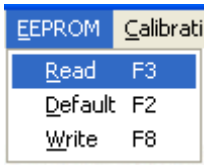


Fig.: 3 - 5

Info

1. Version number of the Service Program

   Click on the hash # before ***File***, then click on ***Info***.

File Menu

1. ***Connect*** (F1)

   Starts data exchange between the PC and the Perfusor® compact S.

2. **Print**

   Prints the current data of the Service Program.

3. **Save**

   Saves data, e.g. on a floppy disk or the hard disk. The proposed file name is to be accepted. Enter the user number 0 upon query.

4. **Configuration**

   Selects language and port.

5. ***End*** (ALT+F4)

   Exits the Service Program. A message is displayed if data was changed and not transmitted to the Perfusor® compact S.

Note

User number: Only for production, acknowledge with 0 in Service.

EEPROM Menu

1. ***Read*** (F3)

   The data of the Perfusor® compact S can be checked and modified in the Service Program after data transfer.

2. ***Default*** (F2)

   Resets data to the default values. Recalibrate unit and enter serial number. As all existing settings are overwritten user-specific settings should be read and documented (View / Save device settings (see „Display / Save the Unit Settings“ ➡ pg. 3 - 3) prior to this function.

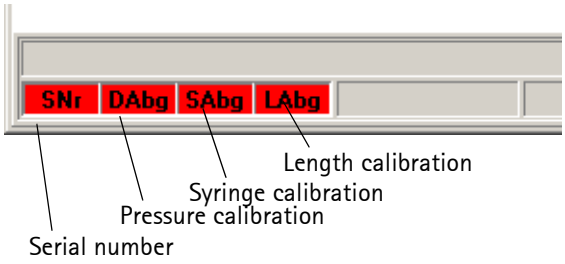


Fig.: 3 - 6

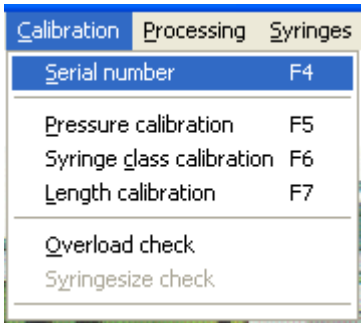


Fig.: 3 - 7

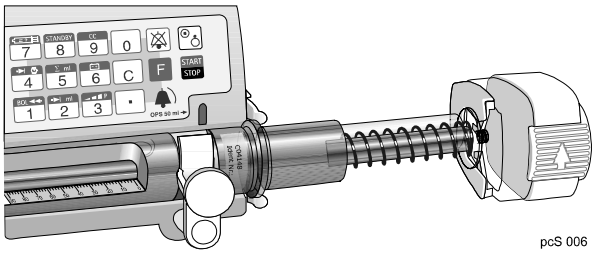


Fig.: 3 - 8

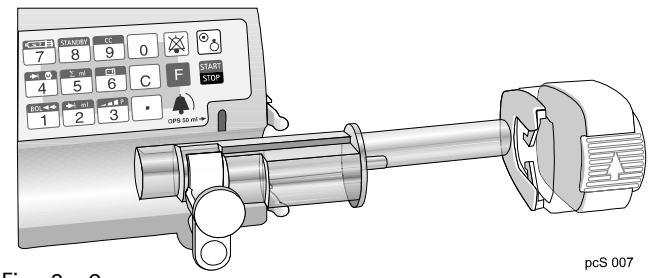


Fig.: 3 - 9

3. *Write* (F8)

   Load changed values in the Perfusor® compact S after you have input the serial number, changed data or after calibration. All the status displays must be ticked. Writing of data is acknowledged by "Writing completed successfully". Save modified data with *Menu* ➨ *Save File*.

Calibration Menu

WARNING

NEVER REMOVE SYRINGE GAUGE WHEN IT IS NOT RELEASED. RELEASE GAUGE BY ACTUATING KEYS F 3 0 (MFC SERVICE CONNECTOR MUST BE PLUGGED).

1. *Serial Number* (F4)

   Enter the serial number when the E-Module is exchanged as otherwise the EEPROM cannot be written.

2. *Pressure Calibration* (F5)

   The motor parameters for setting the 3 pressure stages and the correct switch-off in Bolus mode is determined by pressure calibration.

3. *Syringe Type Calibration* (F6)

   This menu item is used for calibrating the syringe size recognition. Insert the gauge precisely and close syringe holder.

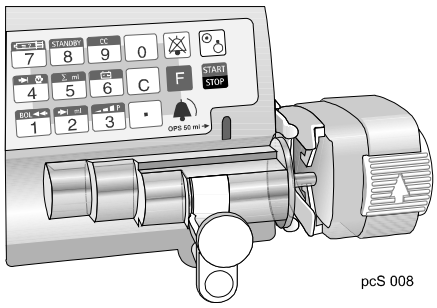


Fig.: 3 - 10

4. ***Length Calibration*** (F7)

   The position of the prealarm light barriers and the drive end is determined by length calibration. The motor steps determined are displayed after calibration is terminated. Insert 0-point and potentiometer calibration gauge. Push drive manually to gauge and lock. Start calibration.

5. **Overload Test**

   The dynamic pressure test is used to determine whether the unit was damaged after having been dropped, due to a shock or impact. The drive must build-up a pressure of >_1.6 bar, and the positive locking sensor must not open.

   Preparation: Calibrate unit. Put out an OPS 50 ml syringe (25 to 30 ml) filled with water, an infusion line and a pressure gauge. The overload test is started at a force of 50% and can be increased in 10% increments up to 1.6 bar. If an open positive locking sensor is detected, the drive is defective and cannot be repaired and must be replaced.

6. ***Syringe Size Test*** (see „Syringe Recognition" ➨ pg. 5 - 4)

   Start communication with switched-on pump. Insert the 0-point and potentiometer calibration gauge or a syringe whose outer diameter is known and check the syringe size recognition. The diameter measured may vary by maximum 0.4 mm.

7. **Parameters**

   Displays the parameters for calibration.

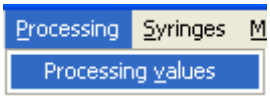


Fig.: 3 - 11

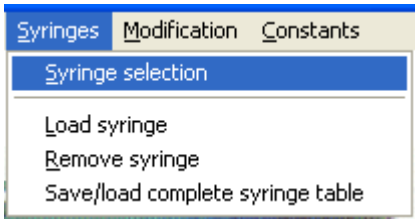


Fig.: 3 - 12

Operation Menu

1. ***History Data***

   The service values are displayed. These values cannot be changed. When the default data was specified the service values are set to zero.

Syringe Menu

1. **Syringe Selection**

   Displays the existing syringe table.

2. **Load Syringe**

   Adds individual syringes to the syringe table.

3. **Remove Syringe**

   Deletes a syringe from the syringe table.

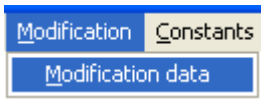


Fig.: 3 - 13

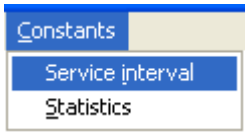


Fig.: 3 - 14

4. **Load / Save Complete Syringe Table**

   The syringe table with the current configuration is saved on the hard disk, so that the selection can be also used for other devices.

Modification Menu

Setting of:

min. rate, max. rate, max. Bolus rate, staff call, alarm tone.

Alarm tone setting:
0=3 Hz interval, 1=static.

Note

Please pay attention to the notes given with the staff call cable.

The values set are to be checked on the Perfusor® compact S when the delivery rate, the Bolus rate and the syringe selection were changed and the Service Program is quit.

Constants Menu

1. Service interval

   Reads and resets the service interval timer. A customer-specific service interval can be set. When the time set has elapsed a service interval alarm is triggered when the unit is switched on.

   The timer can be set to 20440 hours maximum (corresponds to an average operation of 7 hours per day over 8 years). If the timer runs down to zero, a service alarm is triggered every time the Perfusor® compact S is switched on and a service key flashes on the LCD-display. The audible alarm can be acknowledged for the therapy time.

Note

Other menu items are of no importance to Service.

Procedural Instructions for Inspection after Operation of the Service Program

Calibration Serial Number

1. Switch on unit.
2. Start the Service Program.
3. Select *EEPROM* ➨ *Read* and compare in *Calibration* ➨ *Serial Number* with the serial number indicated on the type plate.
4. Switch device off.

Modification of Min. Rate

1. Switch on unit.
2. Insert syringe and confirm (or select), e.g. Omnifix 50 ml.
3. Close syringe holder.
4. Rate < min. rate (as set in the Service Program, normally 0.01 ml/h).
5. START.
6. Alarm.

Modification of Max. Rate

1. Switch on unit.
2. Insert syringe and confirm (or select), e.g. Omnifix 50 ml.
3. Set maximum delivery rate > (e. g. max. rate = 50ml/h > 50.1 ml/h) and press "Start".
4. An alarm is triggered and the maximum rate is displayed.
5. Acknowledge by starting again. The device delivers and the maximum rate is displayed.

Modification of Bolus Rate

1. The Bolus rate is limited by:
   a) the maximum Bolus rate as set in the Service Program
   b) the maximum Bolus rate suitable for the syringe type (please see instructions for use).
2. If the Bolus rate was limited to a value below b) in the Service Program the limitation can be checked when a Bolus rate of 1500 ml/h is input. Press the F button to limit the Bolus rate under the value indicated in b) and confirm again with the F button.

3. Trigger Bolus in delivery mode. Pump must deliver in Bolus mode and the volume infused in Bolus mode is displayed.

Modification of Staff Call

1. Plug MFC service connector on the MFC connector of the unit.
2. Switch on unit and observe service connector.
   When "with switch-on test" is set the red LED will light up for a short moment.
3. Switch on unit.
4. Open syringe holder, an alarm is triggered. The LED on the MFC service connector flashes.
   a) If "dynamic" was set the red LED lights up for one second.
   b) If "static" was set the red LED lights up until the alarm is acknowledged. Acknowledge alarm.
5. Switch device off. When "with Off-alarm" is set the red LED will light up for a short moment.

Modification of Alarm Tone

1. Switch on unit.
2. Insert syringe and confirm (or select), e.g. Omnifix 50 ml.
3. Enter delivery rate and start unit.
4. Open syringe holder, an alarm is triggered.
5. Compare the alarm tone with the settings:
   - 0 = 3 Hz intermittent
   - 1 = continuous tone, unmodulated

Checklist after Operation of the Service Program

CAUTION

Does not replace Check after repair.

		Condition as delivered	Condition as shipped	Check
Calibration	Serial number			❒
Modification	min basal rate			❒
Modification	max. basal rate			❒
Modification	Bolus rate			❒
Modification	Staff call	❒ static ❒ dynamic ❒ Off-alarm	❒ static ❒ static ❒ Off-alarm	❒
Modification	Alarm tone			❒
Syringes	Syringe selection	❒	❒	❒
Syringes delivered	Syringe selection as ..... 20 ml ..... 50 ml	❒	❒	❒

Table 3 - 1

For your notes:

Unit Elements 4

4.1 Fundamental Repair Information

Battery Pack and Batteries

Designation	Ord. No.
Battery pack	3450 1690

Note

Always disconnect unit from mains.

Prior to repair:

1. Switch off the Perfusor® compact S.
2. Disconnect unit from mains.
3. Remove batteries to avoid short circuits or consequential damage.

Note

The battery may only be removed when the device is switched off as otherwise alarm 022 is displayed upon startup. Press the ON-/OFF-button to delete the alarm 022 until the alarm symbol is no longer displayed. If the alarm 105 is triggered afterwards switch the unit off and on again.

Before startup:

4. If batteries are used switch the device first on without mains connection. If the battery pack is used, then the device is to be switched on with mains connection.

Note

Defective batteries must be disposed of according to the regulations, e.g. return to B. Braun (see „Contact Persons" ➨ pg. 0 - 9).

Fitting Plastic Screws

In order to avoid damage to the thread:
Turn anti-clockwise (until the thread is found), then turn clockwise to fasten (max. 0.5 Nm).

Designation	Ord. No.
Small parts kit for 5 units	3450 7736
containing:	
45 KB 30x16,	
5 split rivet for quick reference guide,	
5 screwed split rivet for battery compartment cover,	
5 blind plug for syringe holder,	
5 countersunk screw M 3x10,	
5 flat head screw M 3x5,	
10 flat head screw M 3x6,	
5 board holder,	
5 flat head screw M 3 x 14,	
10 countersunk screw M 4x12,	
25 Ejot KM 22x8,	
15 tamper-proof cap	
Unit connecting lead, hospital grade	3450 5458
Unit connecting lead 220-240 V.	3450 2718

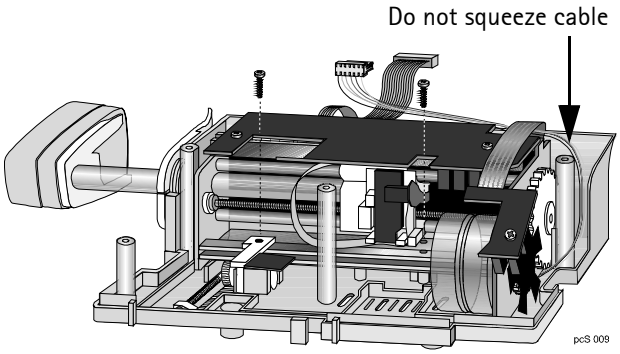


Fig.: 4 - 1

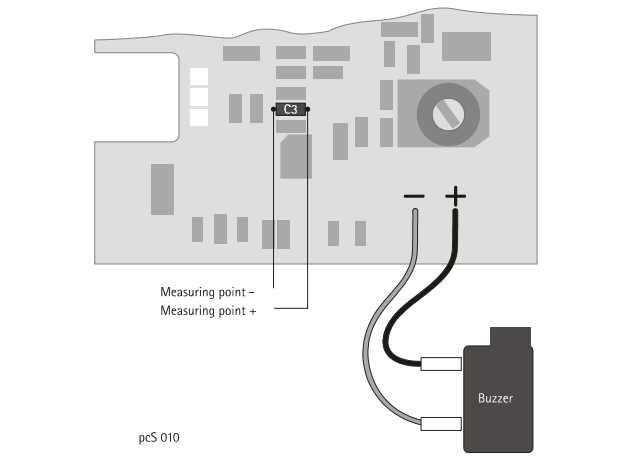


Fig.: 4 - 2

Open Unit

1. Loosen 5 screws from the bottom.
2. Open housing carefully.
3. Pull off the ribbon cable from the E-Module and the connection cable from the motor. Hold the white board holder on the E-Module when disconnecting!
4. Dismount both housing halves.

Always check A-Module before replacing the board

Other modules can only be exchanged without danger of consequential damage if there is no overvoltage.

1. Connect mains cable when the housing is open.
2. Measure voltage parallel with capacitor C3. The set value is 6.2 to 6.8 volt.

Close Unit

1. Close unit in reverse order of opening.

Note

Do not squeeze motor cable (Fig.: 4 - 1).

Checks after Repair

Please see the procedural instructions (see „Procedural Instructions for Inspection after Operation of the Service Program" ➨ pg. 3 - 11).

A calibration in the Service Program is to be carried out if a new E-Module is installed or the drive is replaced (see „Calibration after Replacement of E-Module" ➨ pg. 3 - 3).

4.2 Syringe Table and Quick Reference Guide

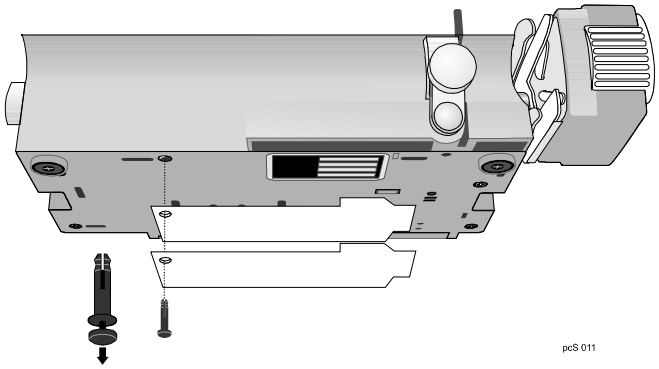


Fig.: 4 - 3

Designation	Ord. No.
Quick reference guide	3450 4702

Exchange

1. Remove split rivet. First pull up the head, then pull out split rivet completely.
2. Insert new syringe table and quick reference guide.

4.3 Syringe Holder

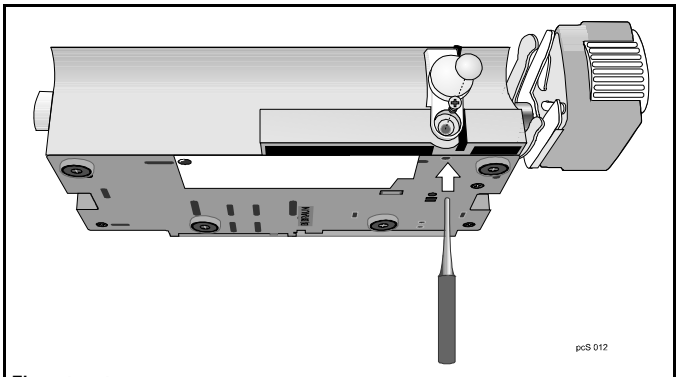


Fig.: 4 - 4

Designation	Ord. No.
Syringe holder with cover cap	3450 4788

Exchange

1. Pierce through the cap and remove.
2. Fasten syringe holder with pin punch.
3. Remove screw.
4. Pull off holder.
5. Insert new syringe holder.
6. Fit new screw (not the old one) and safety lock with Loctite 242.
7. Replace new cap.

4.4 Unit Feet

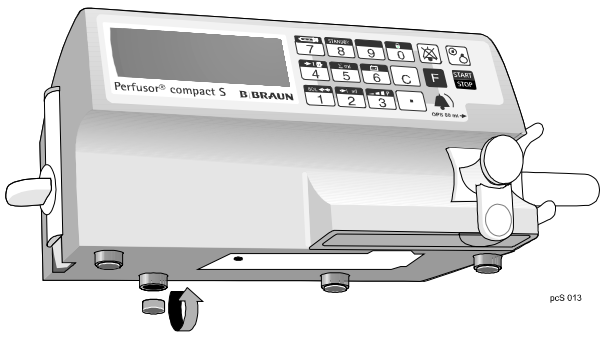


Fig.: 4 - 5

Designation	Ord. No.
Unit feet	3450 6640

Note

The feet can be turned and used once again. Pull feet out and turn around or exchange.

4.5 Battery Compartment Cover

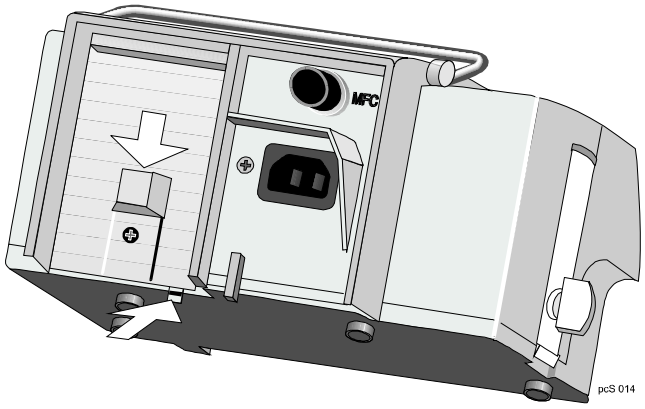


Fig.: 4 - 6

Designation	Ord. No.
Battery compartment cover	3450 6632

Exchange

1. Screw out screwed split rivet.
2. Press the lock and push battery compartment cover downward.
3. Put on new battery compartment cover and press in screwed split rivet.

Note

Make sure that the battery compartment cover does not get jammed. Check for tight fit. The battery compartment cover is also the holder plate for the pole fixation.

4.6 Snap-in Clip

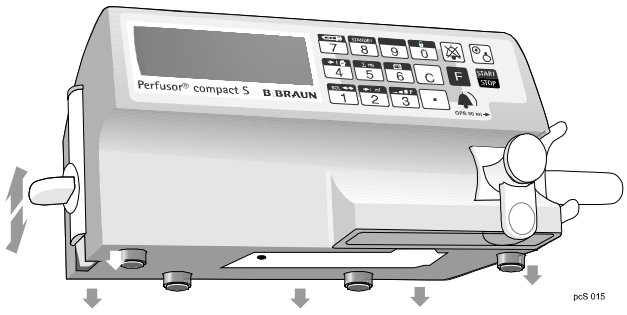


Fig.: 4 - 7

Designation **Ord. No.**

Snap-in clip and snap-in lever 3450 6616

Exchange

1. Loosen 5 screws from the bottom and carefully open housing (pay attention to the cable length).
2. Exchange snap-in clip and snap-in lever.
3. Close unit.

Note

Do not squeeze cable (see „Close Unit" ➡ pg. 4 - 3).

4.7 A-Module

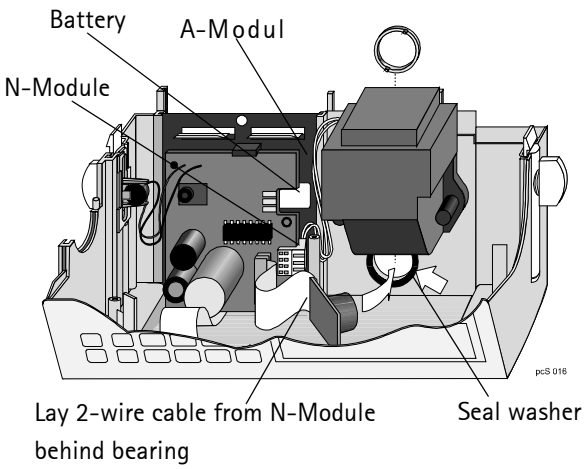


Fig.: 4 - 8

Designation **Ord. No.**

A-Module (battery pack with board) 3450 5288

Exchange

1. Open unit (see „Open Unit" ➡ pg. 4 - 3).
2. Loosen MFC socket nut (M18) from the outside and press MFC socket inwards.
3. Press buzzer out of the holder.
4. Pull off the N-Module connector (slightly pull out the A-Module).
5. Pull off connector on the E-Module.
6. Replace A-Module and check snap-in hook on the board.
7. Assembly is done in reverse order.

   Pay attention to seal washer on the MFC socket. Connect mains connector correctly to the A-Module (cable on contacts). Do not squeeze the cable (see „Close Unit" ➡ pg. 4 - 3).

Note

The connector on the E-Module can be easily connected when the E-Module is swivelled out (see „E-Module" ➡ pg. 4 - 8).

4.8 LS-Clip

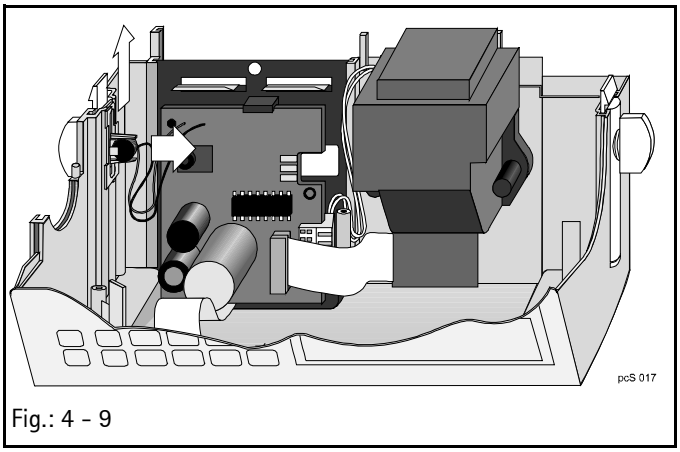


Fig.: 4 - 9

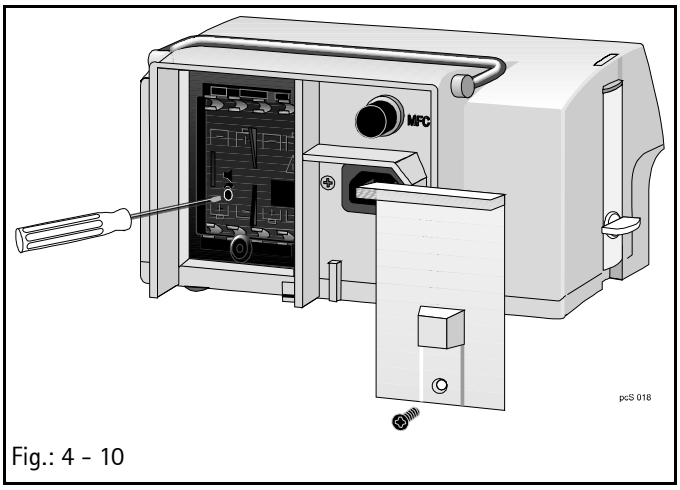


Fig.: 4 - 10

Designation	Ord. No.
LS-clip	3450 7710

Exchange

1. Open unit (see „Open Unit“ ➨ pg. 4 - 3).
2. Press buzzer out of the holder.
3. Pull LS-clip out of the guide and exchange.
4. Assembly is done in reverse order.

Setting the Alarm Tone

1. Open battery compartment. (see „Battery Compartment Cover“ ➨ pg. 4 - 5).
2. Remove batteries.
3. Connect unit to mains and switch unit on.
4. Disconnect unit from mains after switch-on test, pull the mains connector and plug in again to trigger a device alarm (code 22, continuous tone).
5. Put a small flat blade screw driver (carefully) through the battery compartment opening and set the volume desired.
6. Switch unit off via the keyboard.
7. Insert batteries.
8. Close battery compartment.

4.9 E-Module

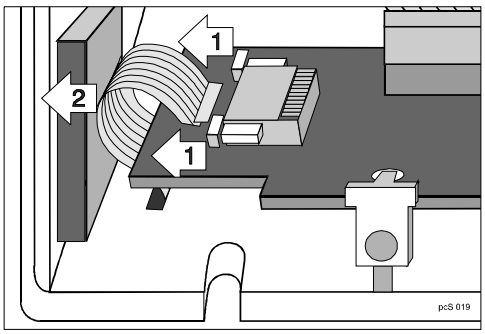


Fig.: 4 - 11

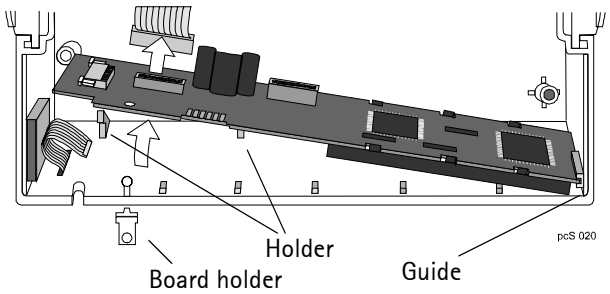


Fig.: 4 - 12

Designation	Ord. No.
E-Module (main board with LCD)	3450 5296

Exchange

Prior to exchange: Read and note down user-specific settings and reset after modification.
(see „Display / Save the Unit Settings" ➨ pg. 3 - 3)

1. Open unit (see „Open Unit" ➨ pg. 4 - 3).
2. Unlock zero force connector on both sides and pull off ribbon cable.
3. Remove white board holder.
4. Push E-Module to the left and swivel out.
5. Pull off connection cable.

Note

Before assembly: Remove protective foil from display, unlock zero force connector and lay ribbon cable.

6. Connect connection cable.
7. Insert new E-Module at the side into the guide and position behind the holder. (Caution! Do not damage the components.)
8. Push ribbon cable in zero force connector until stop and lock on both sides (can get jammed, lock both sides).
9. Push board in the guide to the right and insert a new board holder (must engage in hole).
10. Connect drive cable. Close the unit. Do not squeeze the cable (see „Close Unit" ➨ pg. 4 - 3).
11. Calibrate in Service Program (see „Calibration after Replacement of E-Module" ➨ pg. 3 - 3).

Note

Swivel out the E-Module so that the connector can be connected more easily.
Disconnect or connect ribbon cable only when the E-Module is fastened.

4.10 N-Module

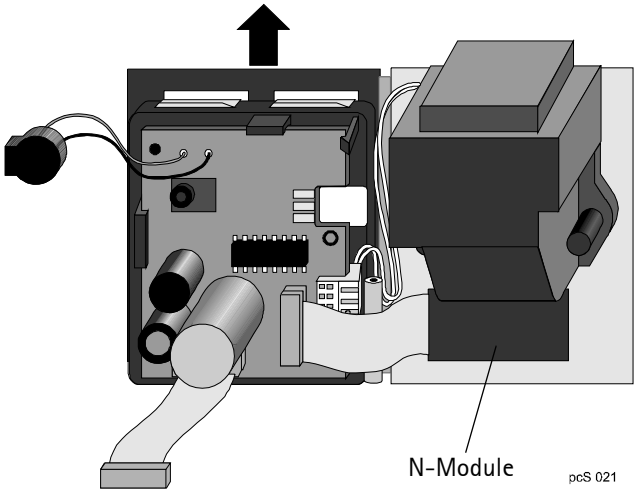


Fig.: 4 - 13

Designation	Ord. No.
N-Module (power supply) 220 - 240 V	3450 5334
Buzzer	3450 8643

Exchange

1. Open housing (see „Open Unit" ➡ pg. 4 - 3).
2. Remove MFC socket.
3. Pull off the N-Module connector on the A-Module (slightly pull out the A-Module).
4. Loosen both screws (on the rear) and exchange N-Module.
5. Assembly is done in reverse order.

Note

Lay two-wire cable with mains connector behind bearing. Connect mains connector correctly to the A-Module (please see figure). Do not squeeze the cable (see „Close Unit" ➡ pg. 4 - 3).

Note

The connector on the E-Module can be easily connected when the E-Module is swivelled out (see „E-Module" ➡ pg. 4 - 8).

4.11 Housing Upper Part, Complete

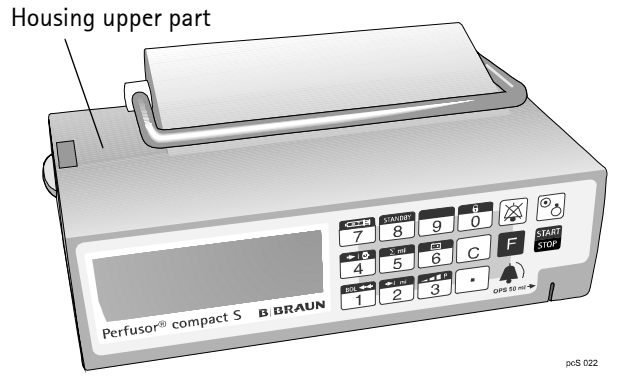


Fig.: 4 - 14

Designation	Ord. No.
Housing upper part, complete with membrane keyboard, carrying handle and joint, screws and small parts	3450 3927

Exchange

1. Open housing (see „Open Unit" ➡ pg. 4 - 3).
2. Modify modules.
3. Close housing.

Note

Do not squeeze the cable (see „Close Unit" ➡ pg. 4 - 3).

4.12 Carrying Handle

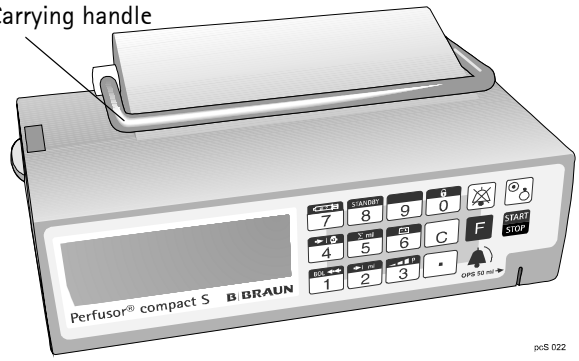


Fig.: 4 - 15

Designation	Ord. No.
Carrying handle	3450 6438

Exchange

Note

Not recommended as special tools are required.

1. Open housing (see „Open Unit" ➨ pg. 4 - 3).
2. Remove A-Module (see „N-Module" ➨ pg. 4 - 9).
3. Pull adapter sleeves out of the joints.
4. Pull off handle and remove both joints.
5. Assembly is done in reverse order.

Note

Press in adapter sleeves with special tool and do not kink.

4.13 Drive

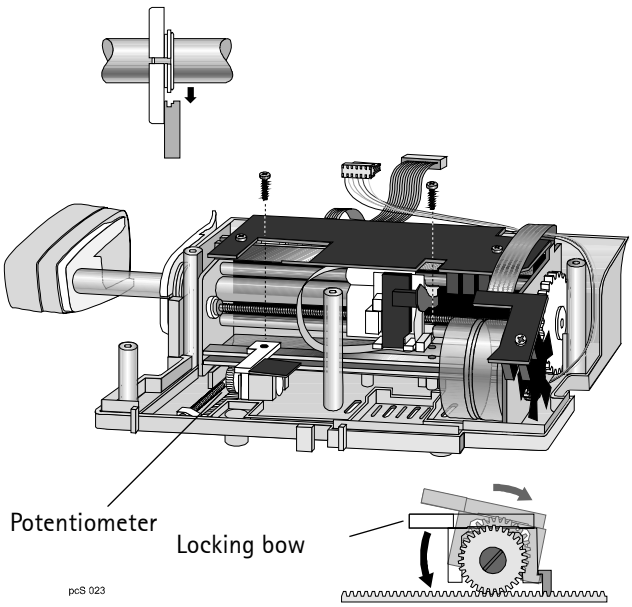


Fig.: 4 - 16

Designation **Ord. No.**

Drive, complete. 3450 5490

Exchange

WARNING

THE DRIVE CONSISTS OF SAFETY RELEVANT PARTS. OPERATIONAL RELIABILITY CAN ONLY BE GUARANTEED WHEN THE DRIVE IS EXCHANGED COMPLETELY.

1. Open unit (see „Open Unit" ➨ pg. 4 - 3).
2. Move drive arm to middle position and lock.
3. Loosen both screws on drive.
4. Remove locking bow from potentiometer and loosen swivel nut.
5. Pull potentiometer to the top and out of the guide and remove drive.
6. Install new drive.
   - Turn potentiometer anti-clockwise until stop,
   - insert potentiometer in the corresponding housing seat,
   - turn toothed wheel on potentiometer back by one tooth to ensure that it is not under tension with the toothed rack. Position scraper ring and axial positioner according to drawing.
7. Tighten nut on potentiometer (teeth of toothed wheel and toothed rack must engage).
8. Hook locking bow into housing bottom. Screw down drive (tightening torque 0.5 Nm).
9. Lay cable according to drawing. Close the unit. Do not squeeze the cable (see „Close Unit" ➨ pg. 4 - 3).
10. Calibrate in Service Program (see „Calibration after Replacement of Drive" ➨ pg. 3 - 4).

4.14 Axial Positioner

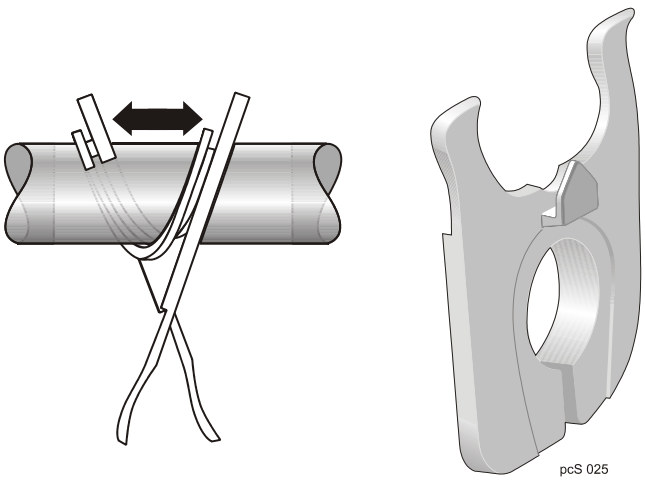


Fig.: 4 - 17

Designation	Ord. No.
Axial positioner	3450 5482

Exchange

1. Open unit (see „Open Unit" ➨ pg. 4 - 3).
2. Move drive arm to middle position and lock.
3. Loosen both screws on drive.
4. Lift drive until the axial positioner is free.
5. Remove axial positioner by forcing apart. Replace new axial positioner and make sure that the scraper ring is correctly fitted.
6. Assembly is done in reverse order.

Note

Do not squeeze the cable (see „Close Unit" ➨ pg. 4 - 3).

7. Calibration is required in Service Program (see „Calibration after Replacement of Drive" ➨ pg. 3 - 4), as the drive was dismounted.

4.15 Drive Board

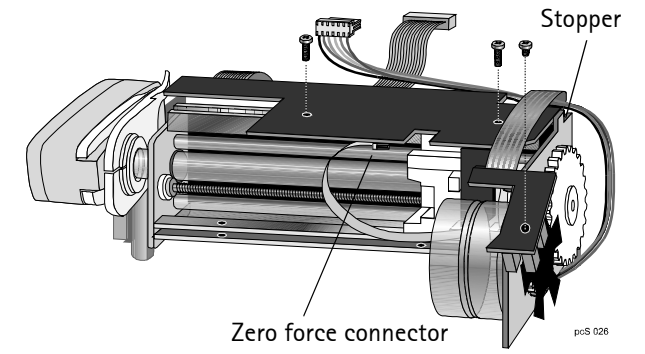


Fig.: 4 - 18

Designation	Ord. No.
Drive board with main PCB and satellite boards for syringe size recognition and recognition of direction of rotation	3450 6268

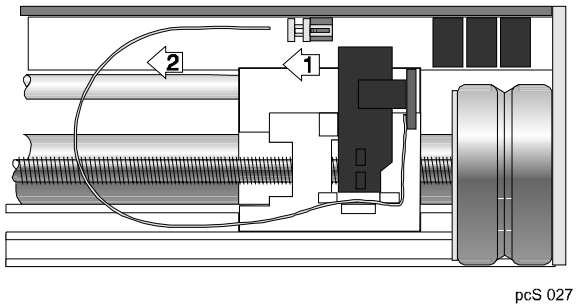


Fig.: 4 - 19

Exchange

1. Open unit (see „Open Unit" ➨ pg. 4 - 3).
2. Dismount drive (see „Drive, complete 3450 5490" ➨ pg. 4 - 11).
3. Disconnect zero force connector on the underside of the main PCB.
4. Loosen main PCB and the direction of rotation board.
5. Remove drive board.
6. Place new main PCB on aluminium profile and slide until stopper (Fig.: 4 - 18) of the aluminium profile from the motor side.

CAUTION

Cable layout according to figure.

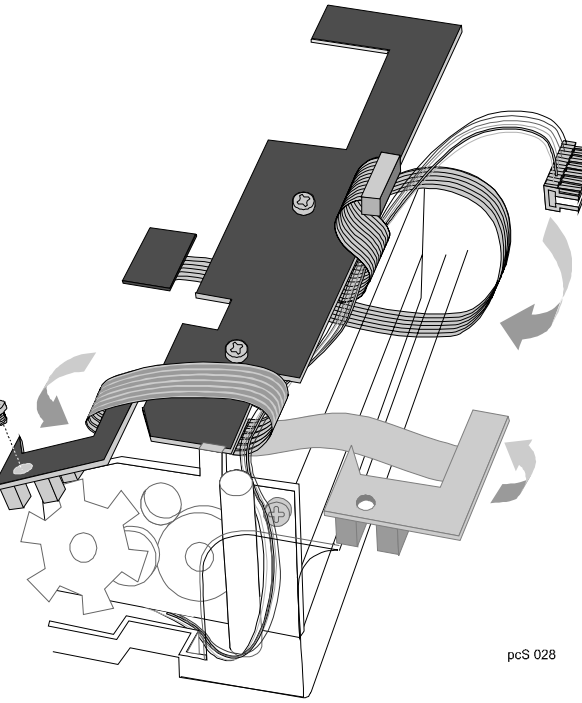


Fig.: 4 - 20

7. Press board against stopper when screwing down. Tighten screws hand-tight.
8. Fix satellite board.
   Cable layout please see Fig.: 4 - 20. Lay motor cable under direction of rotation board prior to fastening the board. Make sure that the slotted disk can turn freely and smoothly.
9. Insert ribbon cable vertically in zero force connector and lock connector with a screw driver. Position connector carefully: the plug contacts can bend!
10. Assembly is done in reverse order (see „Close Unit" ➨ pg. 4 - 3).
11. Calibrate in Service Program (see „Calibration after Replacement of Drive" ➨ pg. 3 - 4).

4.16 Drive Head and Holder

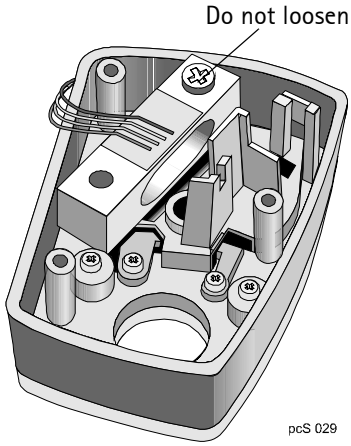


Fig.: 4 - 21

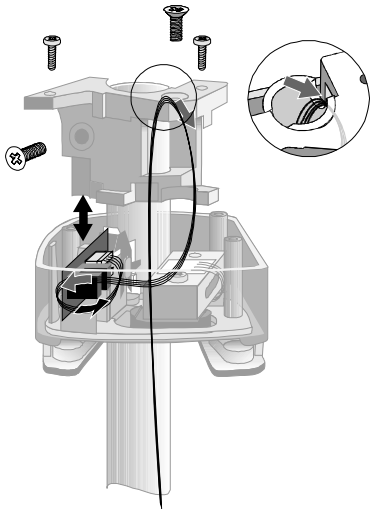


Fig.: 4 - 22

Designation	Ord. No.
Drive head, complete	3450 6250
Holder	3450 6373

Exchange

Note

Please note / outline cable layout prior to replacement!

1. Move drive arm to middle position and lock.
2. Pierce through tamper-proof caps on the drive head and remove caps; loosen screws and remove cover.
3. Pull out square (release shaft).
4. Remove optical switch, pressure pins and pressure spring.
5. Remove board.
6. Disconnect plug connectors.
7. Loosen first countersunk screw (Fig.: 4 - 22) from top, then countersunk screws on the sides. Remove injection-molded bracket.

CAUTION

Observe the handling notes for Loctite 275
(please see data sheet).

8. Mount new drive housing (do not remove transport retainers yet). Assembly is done in reverse order. Secure thread of screws on injection-molded bracket and strain gauge with Loctite 275. Lay cables and do not damage. Housing should have some play when the screws were tightened.
   Tightening torques:
   Metal screwed connections 1.2+0.1 Nm
   Plastic screwed connections 0,2±0,05 Nm
9. Insert pressure pin, pressure spring and optical switch. Lug of optical switch must extend into spring. - Press optical switch several times to ensure that the spring is correctly seated.
10. Connect cable (Fig.: 4 - 25).
11. Push in board until it engages. Bend optical switch slightly to the side and make sure that the pressure spring does not come off.

12. Use tweezers to stow cable in the hollow. Do not squeeze cable.
13. Insert square (release shaft). Do not damage the cables. Place on cover, screw down and press in new tamper-proof caps.
14. Calibrate in Service Program (see „Calibration after Replacement of Drive" ➡ pg. 3 - 4).
15. Remove middle web before fitting the holder.

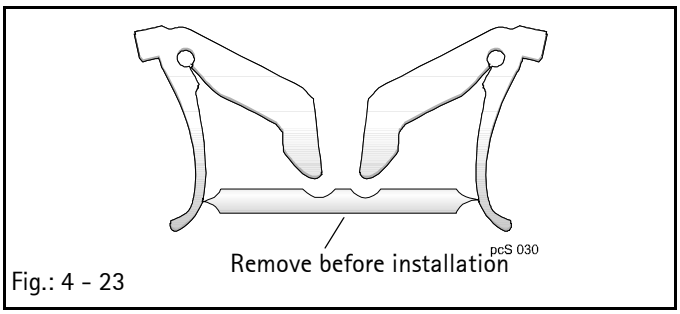


Fig.: 4 - 23

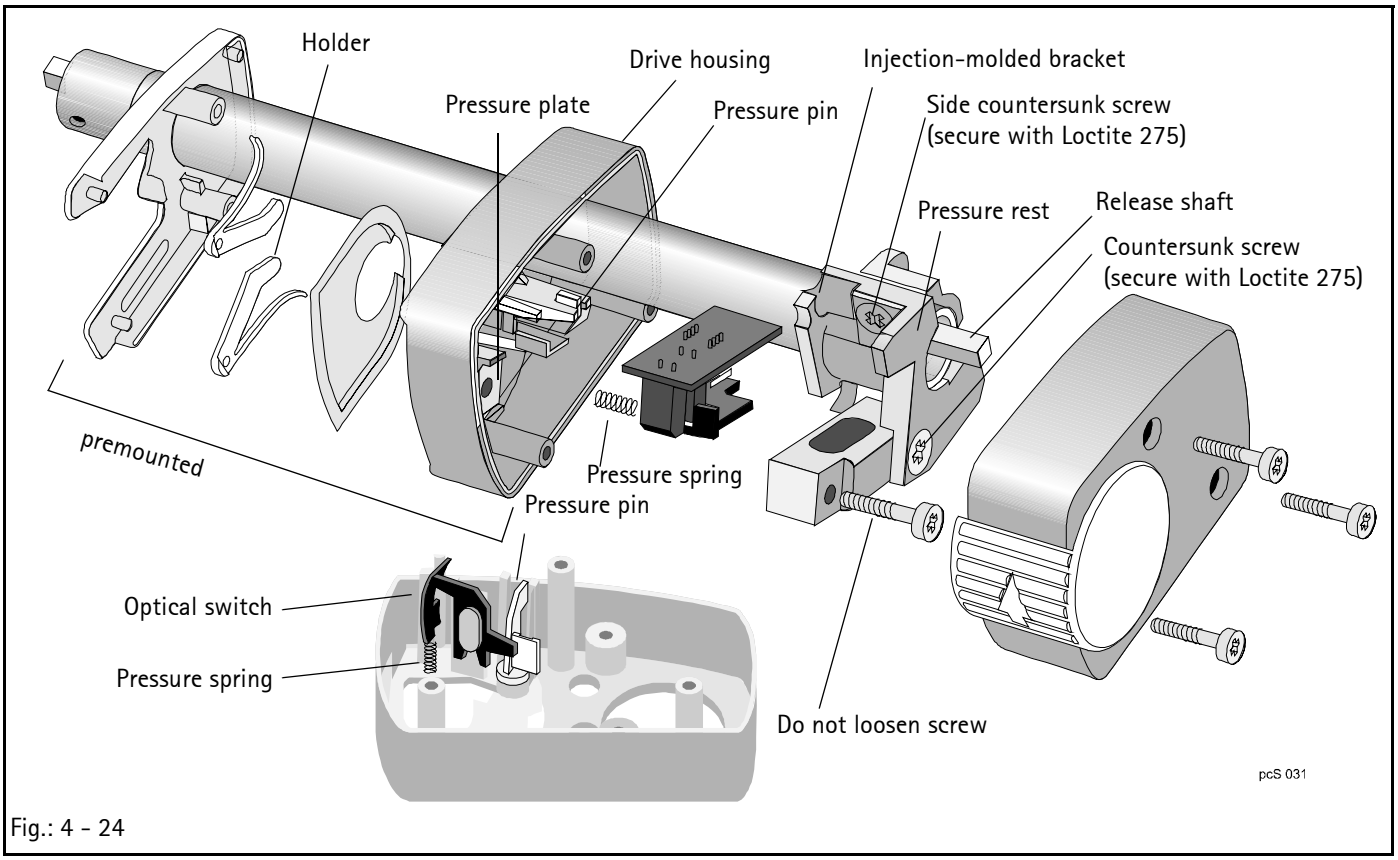


Fig.: 4 - 24

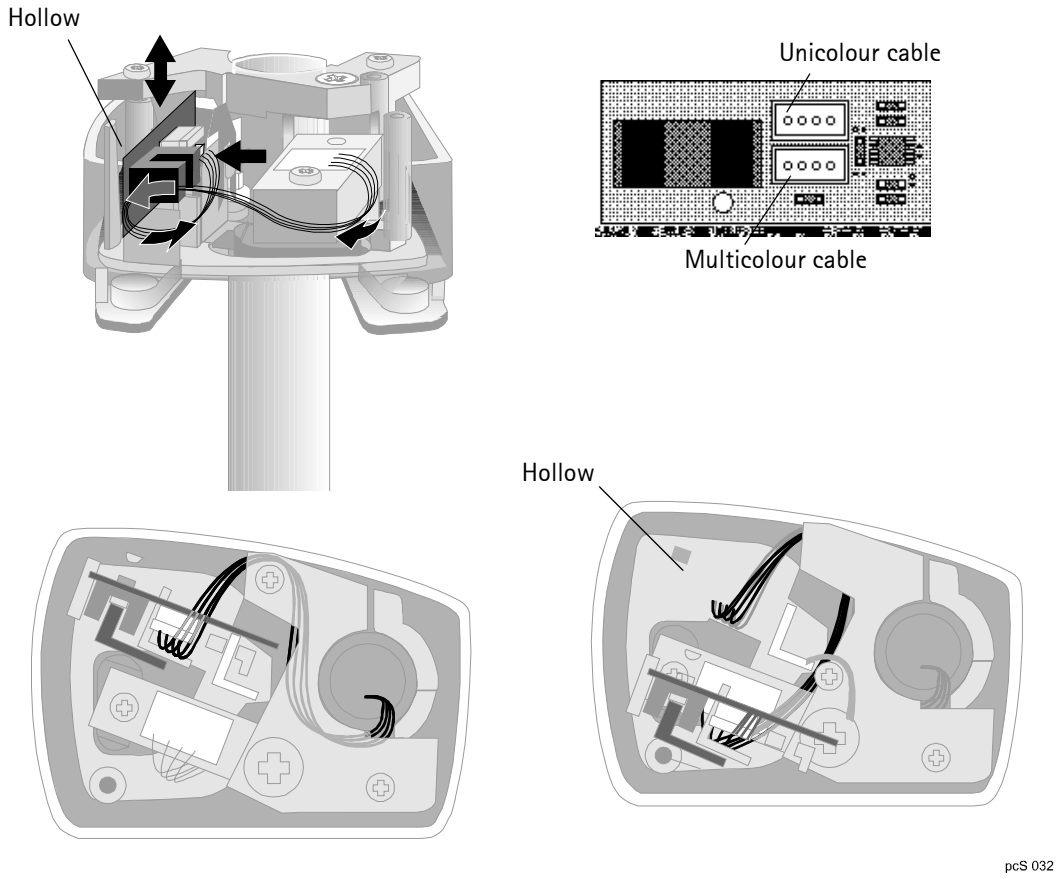


Fig.: 4 - 25

4.17 Clip

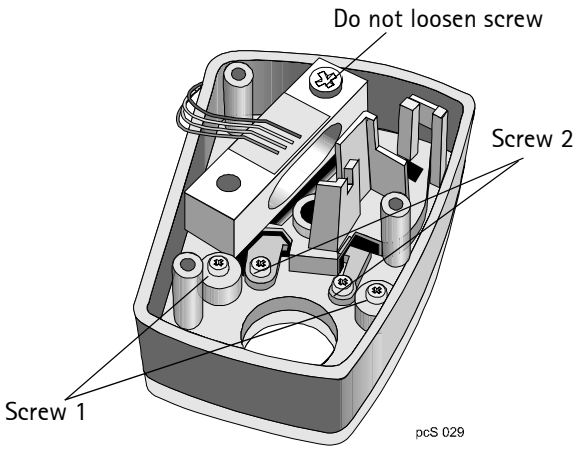


Fig.: 4 - 26

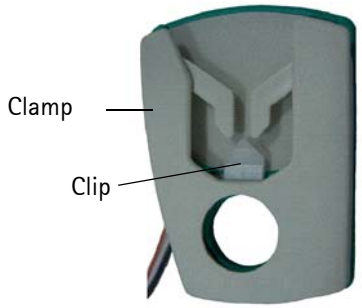


Fig.: 4 - 27

Designation **Ord. No.**

Clip 3477 4327

Exchange

1. Pierce through the tamper-proof cap and remove.
2. Loosen screws.
3. Remove housing cover.
4. Loosen first countersunk screw (Fig.: 4 - 25) from top, then countersunk screws on the sides. Remove injection-molded bracket.
5. Loosen screw 1 (Fig.: 4 - 26).
6. Remove clamp (Fig.: 4 - 27) from drive head.
7. Loosen screw 2 (Fig.: 4 - 26).
8. Remove clip (Fig.: 4 - 27).
9. Assembly is done in reverse order.

4.18 Drive Head Housing

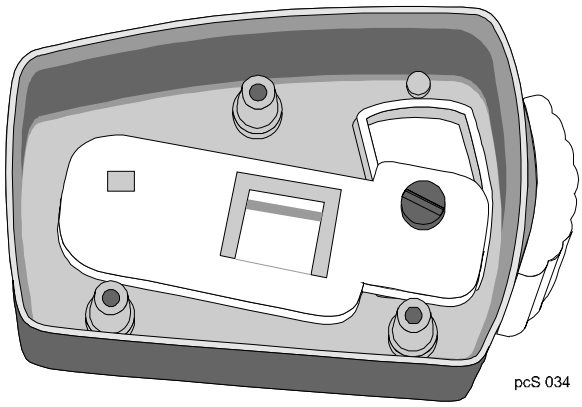


Fig.: 4 - 28

Designation	Ord. No.
Drive head housing	3450 5369

Exchange

1. Pierce through tamper-proof cap and remove.
2. Loosen screws.
3. Exchange housing cover.
4. Insert square (release shaft).

Note

Do not damage the cables.

5. Put on cover and screw down.
6. Press in new tamper-proof caps.
7. Calibrate pressure in Service Program (see „Calibration Menu" ➨ pg. 3 - 8).

4.19 Housing Bottom Part, Complete

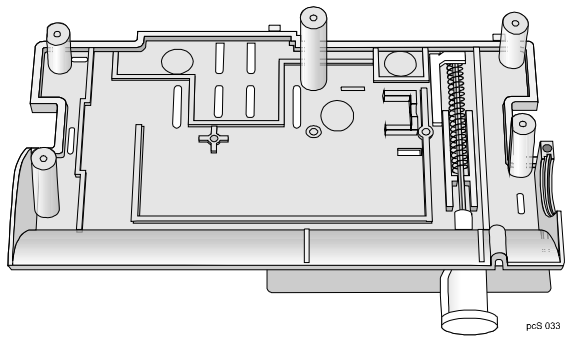


Fig.: 4 - 29

Designation	Ord. No.
Housing bottom part, complete with syringe holder	3450 5237

Exchange

1. Open housing (see „Open Unit" ➨ pg. 4 - 3).
2. Shift type plate.
   a) Warm up type plate with a hair dryer until the adhesive can be removed (not too hot as otherwise the housing is damaged).
   b) Clean adhesive position on new housing and stick type plate. New type plates can only be ordered as spare parts if the old type plates are returned to B.Braun.
3. Modify drive (see „Drive" ➨ pg. 4 - 11).
4. Close housing.

Note

Do not squeeze the cable (see „Close Unit" ➨ pg. 4 - 3).

5. Calibrate in Service Program (see „Calibration after Replacement of Drive" ➨ pg. 3 - 4).

Checks after Repair 5

Check List for Checks after Repair

Carry out the respective check blocks (1., 2. and / or 3) depending on the activity performed.

Visual Inspection	Electrical Safety according to IEC / EN 60601-1 or VDE 0750 and VDE 0751	Functional Inspection
❒ Cleanliness ❒ Completeness ❒ Damage and faults affecting safety ❒ Damage to and readability of the label ❒ Syringe holder, axial positioner, drive head ❒ Syringe table, quick reference guide ❒ Membrane keyboard ❒ Battery compartment cover, battery compartment and -contacts ❒ Unit feet ❒ MFC connector ❒ Holder for pole fixation, side snap-in mechanism ❒ Mains lead	❒ Mains voltage acc. to TSC _____ V ❒ Protective conductor resistance acc. to TSC _____ Ω ❒ Patient leakage current acc. to TSC _____ µA	Mechanical inspection ❒ Holder for pole fixation ❒ Stacking function ❒ Syringe holder ❒ Drive head lock Switch on unit ❒ LCD-display ❒ Self-test ❒ Audible alarm Operation ❒ Infusion ❒ Staff call ❒ Bolus Pressure cut-off with calibration gauge ❒ Pressure stage 1 (6 -10 N)_____ N ❒ Pressure stage 2 (22 -26 N)_____ N ❒ Pressure stage 3 (68 -76 N)_____ N Motor capacity ❒ Pressure stage 1 (8 -18 N)_____ N ❒ Pressure stage 2 (26 -38 N)_____ N ❒ Push-button sensor Syringe recognition ❒ 20 ml ❒ 50 ml Pre- and end alarm ❒ Pre-alarm ❒ End alarm

5 Checks after Repair

Visual Inspection

1. Check unit for cleanliness, completeness, damage and faults affecting safety. Pay special attention to the following parts:
   - Syringe holder, axial positioner, drive head
   - Syringe table and quick reference guide
   - Membrane keyboard
   - Battery compartment cover, battery compartment and -contacts
   - Unit feet
   - MFC connector
   - Holder for pole fixation, side snap-in mechanism
   - Mains lead

Functional Inspection

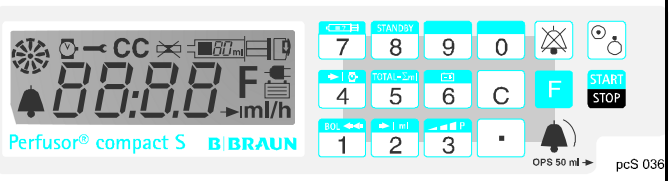


Fig.: 5 - 1

Mechanical Inspection

1. Check function of the holder for pole fixation.
2. Check stacking function of the unit with respect to other units.
3. Check function of the syringe holder with syringe.
4. Check function of the drive head lock.

Switch on Unit

1. Switch on Perfusor and keep ON-button pressed for max. 20 sec. Check the screen display during this time. A device alarm is triggered if the ON-button is kept pressed for more than 20 seconds.
2. The following information appears on-screen when the button is released:

   88:8.8

   11:1.1

   22:2.2

   55:5.5

   b:E. Reference to the instructions for use (hard- and software group)

   Last syringe type
3. An audible alarm sounds three times.

Staff Call

1. Check with MFC connector (see „Modification of Staff Call" ➨ pg. 3 - 12).

Note

The signal mode can be selected via the Service Program.

Push-Button Sensor

(4 different push-buttons)

1. Release drive,
   symbol for drive head and piston rod must flash in the display.
2. Insert spider wrench.
   Drive must lock automatically and the symbol for drive head and piston rod must stop flashing.
3. Actuate lock when spider wrench is inserted.
   Toggle must not stay up, drive must lock automatically.
4. Carry out test with all 4 gauges of the spider wrench.
5. Connect MFC service connector.

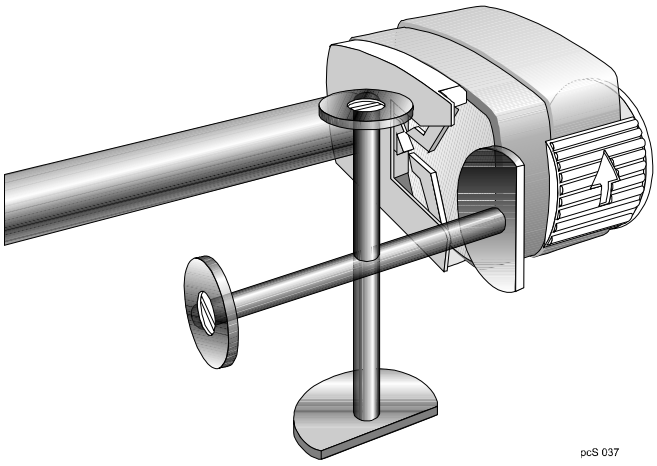


Fig.: 5 - 2 Drive locked, toggle down

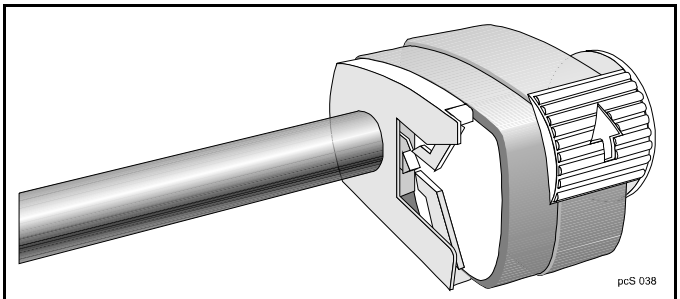


Fig.: 5 - 3 Drive released, toggle up

6. Insert syringe gauge, Ord. No. 0770 3368 (with plate).
7. Close syringe holder.
8. Set syringe type 99.9 by pressing keys 7 C 9 9, 9 F.
9. Press buttons 1, 2, 3 and then START.
10. Pump delivers at 12.3 ml/h. The delivery rate set must be displayed.
11. Open drive lock.
12. Positive locking sensor alarm - drive stops.
13. Press F START button. Drive delivers at 12.3 ml/h.
14. Press buttons C 9 6 F to change the rate to 96.0 ml/h.
15. The delivery rate set must be displayed.
16. Press buttons C, 8 5 F to change the rate to 0.85 ml/h.
17. Pull syringe holder.
18. Staff call function: red LED in MFC service connector lights up for a short moment. Drive stops.
19. Set pressure stage 3:
20. Press buttons F F 3 3 F START.

21. Press button 1, release, press again and keep pressed. Bolus stops automatically after 1.9 ml.
22. Press buttons C 2 0 0 F to change the rate to 200 ml/h.
23. Press buttons 1 C 1 7 F to start Bolus of 17 ml.
24. Then actuate buttons 1 C 1 7 F to start again a Bolus of 17 ml. Pump must deliver until a pressure alarm (68-76N) is triggered.

WARNING

NEVER REMOVE SYRINGE GAUGE WHEN IT IS NOT RELEASED. RELEASE GAUGE WITH KEY SEQUENCE F 3 0.
(MFC SERVICE CONNECTOR MUST BE PLUGGED).

25. Release calibration gauge.
26. Wait until the calibration gauge is completely released. Remove gauge and close syringe holder slowly.

Syringe Recognition

Start communication when pump is switched on. Menu ***Calibration*** ➡ ***Syringe Size Test***.

1. Connect unit to PC with MFC cable.
2. Switch on unit and wait until self-test is finished.
3. Start the Service Program on the PC.
4. Start communication.
5. Press ON/OFF button on the unit. The Service symbol is displayed.
6. Select menu Calibration / Syringe Size Test to read out the information for syringe size recognition.
7. Carry out the following tests.
8. Close syringe holder without inserted syringe or gauge. The syringe must not be recognized.
   - Flashing syringe cylinder symbol without size specification
   - Syringe size (mm/10): 0
9. Pull out syringe holder and turn it clockwise. The syringe must not be recognized.
   - Flashing syringe cylinder symbol without size specification
   - Syringe size (mm/10): > 340
10. Insert 0-point and potentiometer calibration gauge and closed syringe holder. Carry out test according to the following table.

Calibration Gauge	Admissible Measuring Range
9.0 mm	0... 94 mm / 10
15.7 mm	157 ± 4 mm / 10
23.4 mm	234 ± 4 mm / 10
33.0 mm	330 ± 4 mm / 10

Table 5 - 1

Note

The total of the deviations of measurements 2, 3, and 4 must not exceed 1 mm.

Check of Pre- and End Alarm

A check is required after servicing and the TSC. Fill a 20 ml syringe and insert syringe (see „" ➨ pg. 5 - 6)

Carry out test without MFC service connector for being able to answer alarms more quickly (audible alarm).

1. Measurement with filling volume 1 (FV1), rate 1 (R1).
   A pre-alarm must be triggered at syringe pre-alarm volume 1 (VA)1. Enter Bolus volume 1 (VB1):
   key sequence 1 C x F
   The unit stops automatically at end alarm. The syringe piston must not contact the cylinder. Remove syringe and release drive.
2. Measurement with filling volume 2 (FV2)
   A pre-alarm is triggered when the syringe is acknowledged with F. Start with rate 2 (R2). A pre-alarm must be triggered at syringe pre-alarm volume 2 (VA2).

	FV1	R1	VA1	VB1	FV2	R2	VA2
Omnifix 20 ml (type 22.0)	5.5 ml	100 ml/h	4.7 ml	4 ml	3.5 ml	60 ml/h	2.7ml
B-D 20 ml (type 24.0)	4.5 ml	100 ml/h	3.8 ml	3 ml	2.2 ml	60 ml/h	1.8 ml
OPS 20 ml (type 20.0)	4.5 ml	100 ml/h	3.9 ml	3 ml	2.4 ml	60 ml/h	2.0 ml

Table 5 - 2

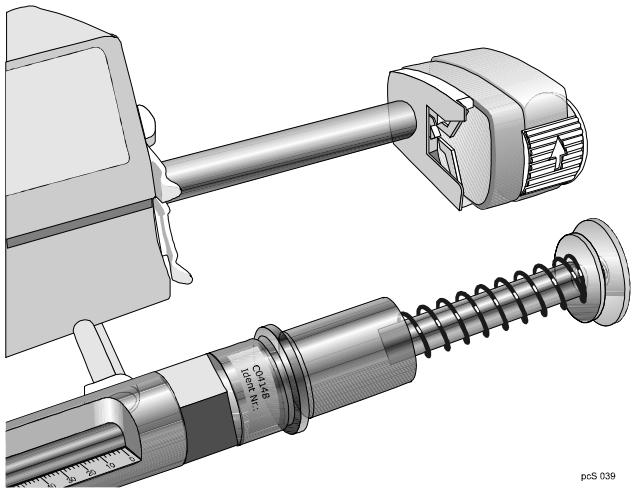


Fig.: 5 - 4

3. If a pressure alarm is triggered instead of an end alarm, the length must be recalibrated (see „Length Calibration (F7)" ➡ pg. 3 - 9)

Pressure Stages, Strain Gauge Check

1. Connect MFC service connector.
2. Insert syringe gauge with plate.
3. Close syringe holder.
4. Select syringe type 99.9 and confirm.
5. Set pressure stage and rate.
6. Start delivery.
7. If a pressure alarm is triggered by the strain gauge, the symbols for pressure alarm and drive head are flashing.
8. Otherwise the unit is to be recalibrated (pressure cut-off through motor current limitation not through strain gauge).

Pressure Stage	Syringe Type	Syringe Type No.	Rate	Reading on Syringe Gauge
1	user-defined	99,9	200	6 ... 10 N
2	user-defined	99,9	200	22 ... 26 N
3	user-defined	99,9	200	68 ... 76 N

Table 5 - 3

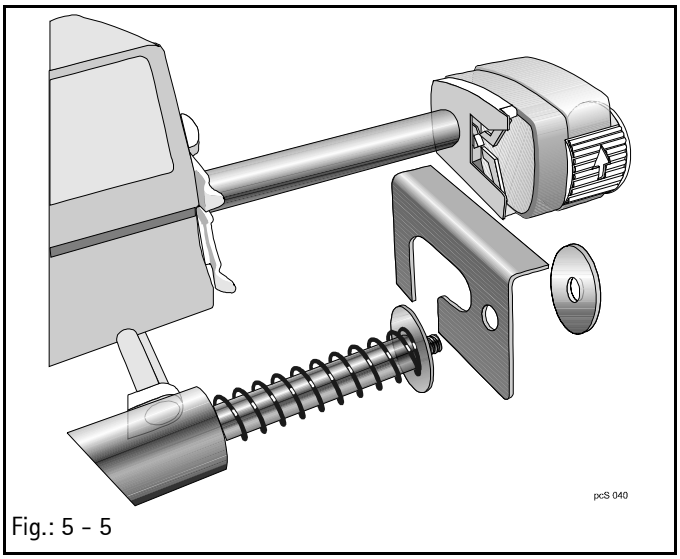


Fig.: 5 - 5

Motor Capacity

1. Connect MFC service connector.
2. Push sheet steel bracket in front of clamp over drive tube.
3. Insert syringe gauge (without plate) in such a way that the thread protrudes through the small hole of the bracket.
4. Close syringe holder.
5. Insert push-button dummy in push-button support.
6. Drive locks. Select syringe type 99.9 and confirm.
7. Set pressure stage and rate.
8. Start delivery.
9. If a pressure alarm is triggered by motor capacity limitation, only the symbol for a pressure alarm is flashing.
10. Check set-up if the drive head symbol is flashing, too.

Current Step (Pressure stage)	Syringe Type	Syringe Type No.	Rate	Reading on Syringe Gauge
1	user-defined	99,9	200	8 ... 18 N
2	user-defined	99,9	200	26 ... 38 N

Table 5 - 4

11. Delete syringe type 99.9 after every check.
12. Open syringe holder.
13. Set 20 ml syringe type desired with key sequence 7 C x x, x F and insert corresponding 20 ml syringe.
14. Close syringe holder.

Electrical Safety

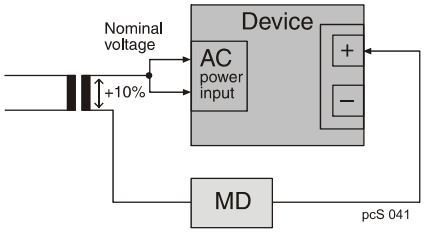


Fig.: 5 - 6

1. Measure mains voltage and note down.
2. Measure protective conductor resistance and note down.
3. Measure patient leakage current as described hereafter and note down.
   - Remove battery pack or batteries. Device is switched off.
   - Apply nominal voltage +10%.
   - Measure patient leakage current between short-circuited mains inlet and plus pole (right top battery compartment).
   - Enter value in check list.

Syringe / Syringe Selection

When the syringe table was changed:

1. Make sure that the corresponding types can be used or were deleted after programming is terminated.
2. To update: Complete syringe table under the device. Delete syringes that do not exist any more.
3. Set selection according to the condition as delivered when the syringe table was not changed. Otherwise the following note should be attached to the unit for safety reasons.

Adhesive Label Factory Setting

Caution: Reset!

Unit was reset to factory settings
during servicing.
Check user-specific settings and reset again!

Maintenance 6

The unit is maintenance-free.

A Technical Safety Check (TSC) is to be carried out every 24 months to check the operational capability of the Perfusor® compact S.

6 Maintenance

For your notes:

Technical Safety Check TSC

Index I
(Master - to be added to the documentation)

Checklist for Technical Safety Check – Every 24 Months

Unit: Infusion syringe pump Perfusor® compact S
Manufacturer: B. Braun Melsungen AG

User

Observe the Service Manual and the instructions for use. All measured values are to be documented. Accessories used should be included in testing. Make exclusive use of calibrated measuring equipment.

Article No.	Unit No.	Year of Procurement

1. Visual inspection

Cleanliness, completeness, damage

- ❒ Syringe holder, axial positioner on drive head

Clamp, holder, membrane

- ❒ Membrane keyboard
- ❒ Mains connection, mains lead and plug connectors
- ❒ MFC (Multi-Function Connector)

Lead and plug connectors

- ❒ Batteries/battery pack

Battery compartment, contacts

- ❒ Unit feet
- ❒ Holder for pole fixation
- ❒ Side snap-in mechanism
- ❒ Screw cover caps

on syringe holder, drive head

2. Functional inspection

Switch on unit.

- ❒ Compare: switch-on test in LCD and audible alarm according to the instructions for use
- ❒ Compare: set delivery rate with display
- ❒ Check: staff call with MFC service connector

Note

You can choose one of the following activation modes in the Service Program:
- static activation
- dynamic activation
- with OFF Alarm.
(only dynamic)
- with switch-on test
- on syringe pre-alarm

- ❒ Check: switch-on test in battery mode.

(see „2. Functional inspection (continued)" ➡ pg. 7 - 2)

3. Pressure cut-off

With syringe gauge, Art. No. 770 3368

CAUTION

Remove syringe gauge only when released.
Danger of injury!

Strain gauge pressure measurement:

- ❒ Pressure stage 1 <8 ± 3 [N]
- ❒ Pressure stage 2 <24 ± 4 [N]
- ❒ Pressure stage 3 <72 ± 6 [N]

Motor capacity limitation

Unscrew plate, use sheet-steel bracket.

- ❒ Pressure stage 1 <13 ± 7 [N]
- ❒ Pressure stage 2 <32 ± 8 [N]

4. Syringes

- ❒ Is the syringe table under the unit present and readable?
- ❒ Can all syringes be selected according to the syringe table?

5. Checking the electrical safety

(according to IEC / EN 60601or VDE 0750/0751)

- ❒ Protective conductor resistance
  Mains lead
  Set value < 0,1 ___ Ohm
- ❒ Measure mains voltage
  ~ AC ____ V
- ❒ Patient leakage current
  Set value ≤10µA ___ µA

6. Accessories

MFC, battery, staff call lead etc.

_____
_____
_____

Note

Charge battery after check!

(Part 1 of 2)

	2. Functional inspection (continued) **Note** Charge or replace battery when the message "Charge battery" is displayed. Repeat test. ❒ Compare: Status display 000 „b" or xxx „A" with battery or battery pack used ❒ Check: Alarm push-button sensor ❒ Check: Alarm positive locking sensor		

(Part 2 of 2)

Test result:
Defects found which could endanger patients, users or third parties.

☐ No ☐ Yes

☐ Repair ☐ _____

Special features / Documentation: _____

_____ _____

B.Braun Melsungen AG
M651 00 00 20 F04 38914611

Make photocopy, fill in and attach to manual.

Inspection performed by:

Date / Signature

Unit handed over to/on

Next deadline for TSC

Procedural Instructions on the TSC 8

Visual Inspection

Unit, in General

Completeness, external damage, safe fit of the battery compartment cover and syringe table.

Check cleanliness of device. Check labels and readability.

Syringe Fastening

Check function with OPS 50 ml syringe.

(Syringe holder, axial positioner, drive head, clamp, and push-button sensor)

Membrane Keyboard

Check adhesion, cleanliness and fit.

Battery compartment cover and battery contacts

Check state of contacts (tight fit, not bent).

Unit Feet

Check unit feet for completeness and proper fit.

Mains Lead and Connector

Completeness, damage.

MFC Lead and Connector

Completeness, damage.

Holder for Pole Fixation, Side Snap-in Mechanism

Check function.

Screw Cover Caps

Check completeness (on syringe holder and drive head).

Functional Inspection

Switch on Unit

1. Switch on Perfusor and keep ON-button pressed for max. 20 sec. Check the screen display during this time. A device alarm is triggered if the ON-button is kept pressed for more than 20 seconds.
2. The following information appears on-screen when the button is released:

   88:8.8

   11:1.1

   22:2.2

   55:5.5

   b:E. Reference to the instructions for use (hard- and software group)

   Last syringe type
3. An audible alarm sounds.
4. Open lock (drive head).
   Check push-button sensor alarm. The piston rod symbol must flash on the LCD-display if a syringe was not inserted.
5. Insert spider wrench. Drive must lock automatically and the symbol for drive head and piston rod must stop flashing.
6. Insert syringe gauge (with plate).
7. Pump delivers at 12.3 ml/h.
   The delivery rate set must be displayed.
8. Open drive lock.
9. Open lock.
   Alarm by buzzer and positive locking sensor alarm. Drive stops.
10. Connect MFC service connector.
11. Press START button. Drive delivers at 12.3 ml/h.
12. Change delivery rate to 96 ml/h (key sequence C 9 6 F) during infusion.
13. The pump delivers.
    The delivery rate set must be displayed.
14. Pull syringe holder.
    Staff call: red LED in MFC service connector lights up. Drive stops.
15. Connect MFC service connector.

16. Pull syringe holder.
    Staff call: red LED in MFC service connector lights up. Drive stops.
17. Switch device off.
18. Disconnect unit from mains.
19. Switch unit on in battery mode.

Syringes

Syringe Table

1. Check whether syringe table is present.
2. Check whether syringe table is readable.
3. Can all syringes be selected according to syringe table?

Pressure Cut-Off

Strain Gauge Pressure Measurement

1. Connect MFC service connector.
2. Insert syringe gauge with plate.
3. Close syringe holder.
4. Select syringe type 99.9 and confirm.
5. Set pressure stage and rate.
6. Start delivery.
7. If a pressure alarm is triggered by the strain gauge, the symbols for pressure alarm and drive head are flashing.
8. Otherwise the unit is to be recalibrated (pressure cut-off through motor current limitation not through strain gauge).

Pressure Stage	Syringe Type	Syringe Type No.	Rate	Reading on Syringe Gauge
1	user-defined	99,9	200	8 ± 3 N
2	user-defined	99,9	200	24 ± 4 N
3	user-defined	99,9	200	72 ± 6 N

Table 8 - 1

Motor Capacity Limitation

1. Connect MFC service connector.
2. Push sheet steel bracket in front of clamp over drive tube.
3. Insert syringe gauge (without plate) in such a way that the thread protrudes through the small hole of the bracket.
4. Close syringe holder.
5. Insert push-button dummy in push-button support.
6. Drive locks. Select syringe type 99.9 and confirm.
7. Set pressure stage and rate.
8. Start delivery.
9. If a pressure alarm is triggered by motor capacity limitation, only the symbol for a pressure alarm is flashing.
10. Check set-up if the drive head symbol is flashing, too.

Current Step (Pressure Stage)	Syringe Type	Syringe Type No.	Rate	Reading on Syringe Gauge
1	user-defined	99,9	200	13 ± 7 N
2	user-defined	99,9	200	32 ± 8 N

Table 8 - 2

11. Delete syringe type 99.9 after every check.
12. Open syringe holder.
13. Set 20 ml syringe type desired: key sequence 7 C x x, x F and insert corresponding 20 ml syringe.
14. Close syringe holder.

Electrical Safety

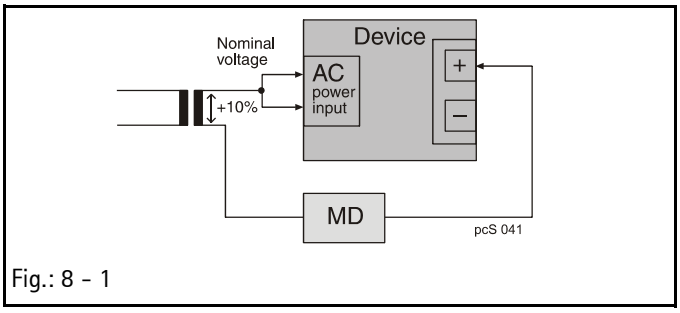


Fig.: 8 - 1

1. Measure mains voltage and note down.
2. Measure protective conductor resistance and note down.
3. Measure patient leakage current as described hereafter and note down.
   - Remove battery pack or batteries. Device is switched off.
   - Apply nominal voltage +10%.
   - Measure patient leakage current between short-circuited mains inlet and plus pole (right top battery compartment).
   - Enter value in check list.

Accessories

Enter accessories, e.g. staff call lead and battery in TSC.

For your notes:

Test Equipment and Special Tools 9

Designation	Ord. No.
Syringe gauge	0770 3368
0-point and potentiometer calibration gauge	0770 3376
Manometer (0 to 4 bar)	0770 1357
Sheet steel bracket and push-button dummy	0770 5050
Spider wrench	0770 5042
MFC service connector	3450 1215
Open-end wrench SW 10	0770 5026
Socket spanner for MFC connector	0770 1497
Service Program on floppy disk	3450 6330
Interface cable	0871 1661

9 Test Equipment and Special Tools

For your notes:

Spare Parts List 10

	Item Designation	Ord. No.
Perfusor® compact S	Battery pack	3450 1690
	Small parts kit for 5 units	3450 7736
	Unit connecting lead, hospital grade	3450 5458
	Unit connecting lead 220-240 V	3450 2718
	Quick reference guide	3450 4702
	Syringe holder with cover cap	3450 4788
	Unit feet	3450 6640
	Battery compartment cover	3450 6632
	Snap-in clip and snap-in lever	3450 6616
	A-Module (battery pack with board)	3450 5288
	LS-clip	3450 7710
	E-Module (main board with LCD)	3450 5296
	N-Module (power supply) 220 - 240 V	3450 5334
	Buzzer	3450 8643
	Housing upper part, complete with membrane keyboard, carrying handle and joint, screws and small parts	3450 3927
	Carrying handle	3450 6438
	Drive, complete	3450 5490
	Axial positioner	3450 5482
	Drive board with main PCB and satellite boards for syringe size recognition and recognition of direction of rotation	3450 6268
	Drive head, complete	3450 6250
	Holder	3450 6373
	Clip	3477 4327
	Drive head housing	3450 5369
	Housing bottom part, complete with syringe holder	3450 5237

10 Spare Parts List

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Appendix A

Revision Service-Documentation

Version 2.1

This Service-Manual was approved by B. Braun on 16.03.2006.

This manual has been completely revised. The most important changes are listed below:

- Changed manual structure
- New software
- New spare parts
- Total list of spare parts
- Modified specification "Clip" for drive head
- Values for strain gauge pressure measurement and motor capacity limitation changed

Current Information

If you hear a scraping noise when the drive arm is pulled out, the straight pin (under the spindle) may have come loose. In this case, an additional straight pin lock (Ord. No. 3450 9100) can be inserted in units up to serial No. 10357. From serial No. 10357 on this straight pin lock is already fitted. Observe the instructions attached.

Frequent Questions

The functions described are available from software version PLBE00014 on.

Question: A short alarm is triggered five times when the type proposed is confirmed, but nothing changes.

Answer: Remove syringe, release drive head, wait for appr. 12 seconds and insert syringe again.

Note: The force measurement is checked for pressure limitation upon a syringe change. The force sensor in the drive head must not be loaded for at least 2 seconds probably for up to 12 seconds.

Question: When the type number is entered, an intermittent alarm is triggered and the display changes between "AAAA" and the syringe which was used last.

Answer: An invalid type number was input

Question: When the type number was input, a beep sounds five times, then the display returns to the original status (before the input).

Answer: The diameter measured is beyond the tolerance for the selected syringe type.

Question: Why do I have to confirm the syringe type proposed manually? Isn't it possible to have the syringe type be detmerined automatically by the unit?

Answer: The pump determines the outer syringe diameter with a precision of appr. ±0,5mm. Syringes from different manufacturers have similar outer diameters but, however, differ in very important parameters:

- Frictional force > important for a correct pressure limitation
- Length > for pre-alarm and end alarm
- Bolus > bolus reduction after pressure alarm
- Inner diameter > directly affects the delivery rate

Therefore, an automatic syringe recognition without monitoring by the user, is not possible.